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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer,

LONDON, APRIL 1, 1881.

EDITORIAL NOTES.

MR. TREVELYAN has just laid before the country his Navy estimates for the new year, and there is much matter therein for congratulation to the country at large. Before detailing these points of advantage we would note that the Engineers as a body are somewhat passed over, leaving many matters of grievance still untouched and unredressed. That the engineers deserve the greatest possible consideration at the hands of the Admiralty may be fully realized; that engineers, stokers, and artificers considerably exceed the whole number of seamen in the Navy. We hope still by the energetic representation of their needs and grievances to aid in pressing these matters upon the attention of the Government. In ships we are promised a rapid completion of those now on the stocks, including the new steel cigar ironclad, the *Polyphemus*. The practical results from this vessel are watched with much interest as it may be the precursor of a revolution in marine construction. Pending, however, the deductions that may arise from the *Polyphemus*, we are promised next year two sea-going cruisers which shall combine the speed of the *Leander* to run 16 knots, and with guns of greater power than the *Thunderer* or the *Devastation* to pierce 16 in. plates. This is a marked advance in the fighting ship of the future, as a point much to be regretted in our present most powerful ironclads, is their great unwieldiness and want of sea-going and roomy qualities. In guns, too, the Admiralty has at last recognized the fact that Woolwich is not infallible, and that an independent committee of scientific naval and engineering experts are most likely to be able to give good and unbiassed reports upon any new systems of guns submitted to their opinion. At any rate the system of breech loading is fully adopted, and we are promised in a year or two a very large number of the largest size of breech loading cannon, constructed with improved explosive chambers and to the latest designs for improved penetration. On the whole the Navy and Admiralty seem full of life and energetic improvement, and are thus a credit and an ornament to the country.

We cannot compliment the Italians as a nation on their sailor-like qualities. There are few men less reliable in a storm or ship-wreck than the excitable natives of Southern Europe. A fearful story of undisciplined terror has reached us as occurring during the wreck of an Italian barque off Cooney Island, when bound for an American Port. The tale is told by the only survivor, that when the vessel struck the captain offered brandy to the crew that they might die drunk. The sea seems to have reminded them of higher duties by washing the brandy out of their reach. Their next appeal was to an image of the Madonna, before whom they knelt shrieking and imploring the Madonna to rescue them. When the waves washed the Madonna away also, they seem to have given themselves up to demoniacal despair, the steward pulling out his knife and cutting his throat. Two or three others seem to have followed his example, and in the midst of this horrible scene the vessel broke to pieces, and the crew of fourteen dead and living were precipitated into the sea. That one sailor by clinging to wreckage reached the shore and lives to tell the tale, forcibly points the moral that all or many might have been saved by well directed and energetic preparations for safety.

Russia is by no means so insignificantly represented amongst the commercial navies of the world as she may be considered by some. The Russian finance minister has just concluded an inquiry through the Department of Manufacture or Commerce into the state of the Russian Commercial Fleet. The Ports of the White Sea have 11 steamers and 575 sailing vessels; Baltic Ports, 63 steamers and 578 sailing vessels; the Black Sea and Sea of Azoff, 171 steamers and 1,964 sailing vessels; the Caspian, 36 steamers and 1,004 sailing vessels; and the Pacific Ocean, 15 steamers. In all, they amount to 296 steamers and 4,121 sailing vessels, of which 1,196 are employed in deep sea navigation, and 3,221 in the coasting trade. A great number of these are also Russian built, viz., 3,695 out of the total, leaving only 722 as having been procured abroad. There is no doubt an immense future before Russia as a commercial and naval country when she is blessed with a more enlightened Government, and her many riches are more fully developed.

The firm of Messrs. Allan Brothers, & Co., are an instance of the great development that has attended the energy and skill of many of our large shipping lines. The Allan Line has only been established some sixty years, and only sailing ships of comparatively small burthen were employed during the first thirty-two. The first steamer of 1,500 tons was built only some twenty-eight years ago, and when we now state that the firm owns twenty-four splendid steamers and a total of 100,000 tons, a remarkable proof is afforded of the energy and skill which must have been needed to create and foster a business of such magnitude. The latest addition to the fleet is the *Parisian* steel built by Messrs. R. Napier & Sons, of Glasgow, which has had a most satisfactory trial on the Clyde, and is now about to take her place in the service from the Mersey. The *Parisian* is one of the most perfect of a splendid line.

An important deputation from the Chamber of Shipping waited upon Mr. Chamberlain to demur against further restrictive legislation upon grain cargoes, pointing out that they believed the present Act, if fully carried into effect, gave ample power to the President of the Board of Trade to put a stop to dangerous loading. Colonel Hill gave an example trom Messrs. Turnbull's returns that their ships had made 271 voyages safely from the Black Sea and Sea of Azoff with grain in bulk. Mr. Glover drew attention to the fact that ship-owners who had gone to considerable expense to comply with the requirements of the present Act would be denied the benefit of the exemptions offered on those conditions. Other members stated that to require "feeders" in single decked ships would, in all probability, create a new source of danger to life and property, by increasing the number of openings by which the sea might get into the hold. Mr. Chamberlain was, however, not disposed to admit that there was not still great need for further precautionary measures against loading in bulk as the last three months have shown 25 grain and 77 coal vessels have been lost out of 197. We, however, have much satisfaction in drawing our readers' attention to the fact that Mr. Chamberlain stated the Board were quite prepared to pass vessels constructed on a safe plan for the grain trade, such as he was aware were now built. We cannot do better than refer our readers to several satisfactory plans for grain loading, such as we have illustrated in past issues. We are glad to note also that Mr. Chamberlain proposes to bring a Bill in soon for the formation of a Shipping Commission to be elected by ship-owners, and to act as arbitrators in disputes between ship-owners and the Board of Trade. Many of our readers must have felt the want of such a tribunal, and it is to be hoped that many vexed questions of load line will be satisfactorily settled by it.

The *Shah* is to be fitted with an entirely new and more powerful armament, advantage being taken of her refit to effect this. It is not before it was wanted, as it must be fresh in the memory of all how she and the *Amethyst* allowed the Peruvian ship, *Huascar*, to slip through their fingers. She was then armed with eight comparatively useless 64-pounders, and with only a couple of 12-ton nine inch revolving chase guns, and sixteen six-and-a-half ton 7-inch broadside guns. In her new armament she is to be furnished with two 8-inch and twenty-four 6-inch long breech-loading rifled weapons with great penetrative power, the 64-pounders being wholly dispensed with. In addition to the above she will be provided with two Gatling guns, and six Nordenfelt guns, which are excellent weapons at close quarters or against torpedo craft. he will also be fitted with twelve 14-inch Whitehead torpedoes. The *Shah* will thus, as far as her armaments go, be one of the most powerful cruisers afloat, and from her ample interior accommodation certainly one of the pleasantest ships afloat.

THE Americans are proposing to construct a new fire boat on a large scale, for the extinction of the numerous fires which occur in New York and Brooklyn on the river front. The hull is of iron, 250 ft. long and 40 ft. beam. She has two distinct engines driving the paddle wheels, so that one may go forward whilst the other goes back so as to enable her to turn on a centre in almost any direction. The boilers are 3,000 horse-power, and are so constructed that their full power may be used either on the paddles or on the pumping engines. The discharge pipes are two in number, fitted to a vertical stand pipe like a mast in the fore part of the vessel. This stand pipe is supplied by water from the forcing pumps. The upper discharge pipe is moveable on trunnions anywhere round the vertical pipe, and has a variable discharge orifice of from 6 to 10 in. diameter. The lower discharge pipe, also moveable on trunnions, has a nozzle of 20 in. diameter. These nozzles are enormous, the largest being at least 400 times the volume of an ordinary 1 in. fire nozzle. The boat is also fitted with a gun to fire wooden projectiles to break down any opposing wall or confined space, to which no other access can be obtained. This is altogether a startling innovation in fire engines and promises to immediately flood any fire within reach.

ORDER FOR ANOTHER LARGE STEAMER.—Messrs. James and George Thomson, the builders of the *Servia*, have just closed a contract with the Hamburg American Steamship Company, to build for them a very large steamer for the Hamburg and New York passenger and mail service. She will be a vessel of 5,500 tons, of somewhat similar proportions to those of the Allan liner *Parisian*, and will be the largest steamship in the German mercantile marine.

THE following vessels are now on the ways, being constructed on the Tyne. At Messrs. C. Mitchell & Co.'s yard the four gunboats for China are nearly completed; the same firm have seven steamers on the ways. Messrs. Wigham, Richardson & Co. have five large new steamers on the stocks. Messrs. Leslie & Co., at Hebburn, have eight new steamers in hand, besides a large new steamer in the graving dock, fitting out for Liverpool owners. Messrs. J. Schlensiger & Co., have three new steamers in hand. Messrs. Swan & Hunter have three on hand. At the Wallsend Shipway the Antwerp mail steamer *Helvetia* will shortly be completed, after which she will proceed to Antwerp to resume her station, from thence to New York. Messrs. Clelland & Co. have three steamers on the ways repairing. The Tyne Iron Shipbuilding Co. have four boats on the stocks. Messrs. Palmer & Co. have four new steamers on hand at Willington Quay, and several in course of construction at Jarrow. Messrs. J. T. Eltringham & Co. are building three or four tugs at South Shields. Messrs. Thomas and William Smith have three new coasting steamers on hand. From the foregoing it will be seen what magnitude shipbuilding is now assuming in the Tyne, giving employment to several thousands of men, who are enjoying excellent wages.

THE LIMITATIONS OF THE STEAM ENGINE.

From the Journal of the Franklin Institute.

By WILLIAM DENNIS MARKS, Ph.B., C.E.,
Whitney Professor of Dynamical Engineering, University of Pennsylvania.

PERHAPS there is no more unsafe proceeding in science than to attempt to predict the limitation of the development of any of its results. Yet the theory of the steam engine has so far been developed as to seem to permit us to mark out the boundaries of its progress with tolerable accuracy.

At least, we trust that a full criticism of its present deficiencies, and a deduction of its limitations from known laws, will interest such of our readers as are engaged in the improvement of this machine, to which our civilization is more indebted for its advancement than to any other one thing.

In this article we will consider the steam engine alone, as it is in no wise responsible for the economy of the boiler which supplies the steam, or for the losses incurred in conveying the steam from the boiler to the engine.

The boiler should be considered apart from the engine, and it is well to incidentally remark here that the performances of the best types of boiler leave but little room for improvement so far as evaporation is concerned.

It is rather in the utilization of the steam after it reaches the engine that we must look for progress, and in this point, we take it, lies the value of a thorough investigation of the machine itself.

The well-known formula for the horse-power of a steam engine* contains three factors, which can be varied at will: the mean effective pressure, the volume of the cylinder, and the number of strokes per minute.

Concentration of power in a small space is the greatest attribute of the steam engine; it is its power to concentrate the strength of thousands of horses in the space of an ordinary room that renders the steam engine so useful and indispensable to us.

For this reason we cannot go on increasing the volume of the steam cylinder indefinitely without a proportionate increase in power, and it is only necessary to remark to mathematicians, with regard to the proportions of the cylinder, that that cylinder whose stroke equals its diameter contains the maximum of volume with the minimum of condensation surface.

The importance of reducing condensation surface is becoming more and more appreciated among engineers, and shortening the stroke will prove less of a bugbear when the laws of inertia, as applied to the reciprocating parts of a steam engine, are better understood.

Shortening the stroke has the further advantages of shortening the space passed over by the piston head during a given number of strokes, and consequently of reducing the wear on the piston head as well as of rendering the engine more compact for a given power.

The following formula gives for any assumed horse-power, mean effective pressure, and number of strokes per minute, the required common diameter and stroke of cylinder, *in inches*:

$$d = 79{\cdot}59\sqrt[3]{\frac{(HP)}{NP}}\ \dagger$$

Concentration being attained, the next important consideration that arises is *economy of steam*, and this is the battle ground upon which the struggle for supremacy among our engine builders is to-day being practically fought out, while the physicists are quite as hotly engaged in a dispute as to the relative theoretical merits of steam, hot air, and electric engines, into which we will not enter.

Practically, we think that, as far as the steam engine is concerned the impossibility of supplying to the steam in the cylinder any appreciable amount of heat by means of steam or hot air jackets is acknowledged by all, and the jacket is only expected to keep the cylinder warm, and prevent it from abstracting heat from the steam inside the cylinder.

---

* $\frac{PLAN}{33000} = (HP)$. In which P = mean effective pressure per square inch, L = length of stroke in feet, A = area of piston in square inches N = number of strokes per minute, (HP) = indicated horse-powers, $\frac{AL}{144} = V$ = volume of cylinder.

† *The Relative Proportions of the Steam Engine*, p. 26. Marks.

The jacket proving imperfect, we must find other means for preventing condensation by cooling, and they are these: Diminution of condensation surface, as already stated above, and shortening of the duration of the time for condensation, which means an increase in the number of strokes of the piston. The effect upon the structure of the engine of increased rotative speed is not injurious to the engine, as so positively stated by many engineers; but, if attempted, rapid speed requires a far greater knowledge of the dynamics of the steam engine than has as yet been applied to it by many constructors, and will almost inevitably shake to pieces a faultily designed structure.

The length of the crank pin and shaft bearings must also increase directly with the number of revolutions made, while their diameter, within ordinary limits as to pressure and speed, has no appreciable effect upon the heating at the bearing; but when we consider the practical fact, that the eccentrics, possibly because of greater speed of rubbing surfaces, are always sources of large frictional losses, it would seem best to make the diameters of all bearing journals just as small as the pressures allowable upon the surfaces of contact will permit. Much yet remains to be determined with regard to the laws controlling bearings. A very interesting work has been published on *Friction and Lubrication*, by Professor Thurston, but it is to be regretted that he has formulated the results of his experiments with so much positiveness, as other and careful experimenters have found it difficult to obtain results which clearly verify each other.

He has shown conclusively that the coefficient of friction is much affected and reduced by the state of the rubbing surfaces, by the method of lubrication, and by the quality of the lubricant.

Perfect, almost mirror-like, surfaces reduce the coefficient of friction far below the 3 to 5 per cent. formerly stated by Morin as a minimum, provided a continuous lubricating apparatus is used with good sperm oil, and it will be found that a costly lubricant such as sperm oil is cheapest where care is exercised not to waste in its application.*

The important influence of the number of turns upon the length of bearings has not been clearly enough understood to prevent accidents from heating of the crank pins and bearings, which is one of the most annoying mishaps which can befall an engine, and at times requires the utmost vigilance of the engineer for its prevention.

The great difficulty attendant upon making bearing and shaft press uniformly throughout the length of the journal has almost forced the use of Babbitt or soft metal for high speed engines, and where proper care is taken in proportioning the results have justified its use.

Crank pins shrunk in by heating the crank, are apt to be out of truth, no matter how carefully the work has been done, as heat is apt to warp the crank.

Pins should be forced in cold, or the crank and pin be forged in one piece as in the case of most small double cranks.

High rotative speed, while increasing the power of the steam engine, also renders it more compact and diminishes the weight of the fly-wheel necessary to obtain regularity of speed.

Rotative speed has, however, its limitations, independently of the trouble sometimes caused by the heating of bearings.

For instance, it can be shown that if the safe stress in tension upon cast iron equals 1800 pounds per square inch, that a cast iron ring can be revolved safely at a maximum lineal speed of 8,000 feet per minute, or thereabouts, which at once places a limitation upon the rotative speed of the fly-wheel, and demands reduction of its diameter as the rotative speed is increased.

Let N = the number of revolutions per minute.
,, D = the diameter of cast iron ring, in feet.

We have

$$\pi D N = 8000$$

or

$$D N = 2546.$$

This formula would limit the diameter of the fly-wheel of a pair of engines, to make 600 revolutions per minute, lately proposed by the distinguished engineer, Mr. Chas. T. Porter, to about 4 feet.

Of course, as the tensile strength of the material of which the fly-wheel is made is increased, the lineal speed at which it can be driven is increased.

If we take 5000 pounds per square inch as the safe tensile strength of the steel tire of a locomotive, we find its lineal speed to be limited to about 2½ miles per minute, or 150 miles per hour, and it only remains for our engineers to provide boiler capacity and road bed adapted to such speeds, in order that they may be realized by a properly constructed locomotive.

This speed would shorten the time between New York and Philadelphia to 36 minutes.

High rotative speed necessitates special precautions as to the weight of the reciprocating parts.

If we impose the condition that the initial and final stresses upon the crank pin be equal, we must make the centrifugal force of the reciprocating parts (piston, piston rod, cross head and connecting rod), supposed to be concentrated at the crank pin, equal to half the difference of the initial and final steam pressures upon the whole piston head.

High rotative speed has also demanded a change in the form of the connecting rod, which was formerly largest at its mid-length, but has of late years been made largest at the crank pin end; a consideration of the stress upon it, due to its own inertia, would place the point of greatest stress at 0·578 of its length from the cross head end, but the stresses due to the twisting of the crank pin in its boxes recommends as a measure of safety that the rod be made largest at the crank pin neck, and tapered down from that to the cross head.

In a properly proportioned engine, of any assumed horse-power, the *only* method of reducing the weight of the moving parts is to increase the rotative velocity; lengthening the stroke will not do it.

The points of interest with regard to the volume of the steam cylinder and the rotative speed of the engine having been touched upon, there remains to be considered the mean effective pressure of the steam.

In the "MARINE ENGINEER" for February, 1881, the writer has shown, under the assumption that the steam expansion curve is an equilateral hyperbola, that the most economical point of cut-off for steam engines is determined by dividing the absolute back pressure by the absolute inital pressure of the steam.

Indicators do not give such curves, even if in perfect order, unless the steam is a little wet; but the approximation is sufficiently close for all practical purposes.

A more accurate way would be to say that the most economical point of cut-off is attained when the final steam pressure equals the back pressu e; but our first statement is more convenient in form and will serve our purpose, with all the practical accuracy necessary,

Let P = the mean effective pressure of steam in pounds per square inch.

Let P_b = the initial absolute pressure of steam in pounds per square inch.

Let B = the back absolute pressure on piston in pounds per square inch.

Let e = the fractional part of the stroke at which the steam is cut off.

Let V = the volume of the steam cylinder in cubic feet.

Then we have

$$P = e P_b \left[1 + \text{nat. log.} \frac{1}{e} \right] - B$$

Let (HP) = the indicated horse-power.
,, S = the specific volume of the steam for pressure, P_b.
,, W = the weight of water used per horse-power.

We have

$$(HP) = \frac{P L A N}{33000}$$

in which L = the length of stroke in feet.
N = the number of strokes per minute.
A = the area of the piston head in square inches.

Therefore.

$$(HP) = \frac{\left\{ e P_b \left[1 + \text{nat. log.} \frac{1}{e} \right] - B \right\} V N}{33000} \times 144$$

since $144\, V = L\, A$.

The quantity of water used during one minute is

$$62\tfrac{1}{2} \frac{e V N}{S}$$

62½ pounds being taken as the weight of one cubic foot of water.

---

* Let l = the length of the crank pin, in inches.
,, L = ,, stroke in feet.
,, (HP) = the indicated horse-power.

Then, for marine propeller engines, a practical formula, giving safe lengths, would be

$$l = 0{\cdot}622 \frac{(HP)}{L}$$

One-fourth of this length will serve safely for side-wheel or stationary engines.

For locomotive engines practice seems to prove that $l = \cdot013\, d2$ is a safe value, in which d = diameter of the steam cylinder, in inches.

For crank shaft bearings, letting R = the whole maximum weight on bearings, and N = the number of strokes per minute, we have $l = \cdot000005\, R\, N$.

Therefore, the weight of water used per horse-power is

$$W = \frac{62\frac{1}{2}\,\frac{e\,V\,N}{S}}{\frac{144}{33000}\left\{e\,P_b\left[1 + \text{nat. log. }\frac{1}{e}\right] - B\right\}V\,N} = \frac{14323\,e}{S\left\{e\,P_b\left[1 + \text{nat. log. }\frac{1}{e}\right] - B\right\}}$$

If in this last formula we substitute $\frac{B}{P_b}$ for e, we obtain the theoretical minimum quantity of water to be evaporated per horse-power, and

$$W = \frac{14323}{P_b\,S.\ \text{nat. log. }\frac{P_b}{B}} = \frac{6220\,3}{P_b\,S\ \text{log. }\frac{P_b}{B}}$$

For one horse-power per hour we would have, multiplying by 60,

$$60\ W = \frac{373218}{P_b\,S\ \text{log. }\frac{P_b}{B}}$$

As, for instance, for a non-condensing engine having a gauge pressure of 45 pounds, and cutting off at ¼ the stroke, we find the minimum limit of evaporation of water required to be about 24 pounds of water per horse-power per hour.

Mr. Charles E. Emery has experimentally realized as low as 39 pounds of water per horse-power per hour with the given pressure, in small non-condensing engines.

If, in the last formula, we regard the product of the pressure, and the specific volume, $P_b\ S$, as constant, which it is with a considerable degree of approximation, we observe that the economy varies directly as the log. $\frac{P_b}{B}$, showing that both Watt and Oliver Evans were partially right in their attempts to increase the economy of the steam engine. Watt was right in perfecting more and more the vacuum obtained, and Evans in increasing the steam pressure at the boiler. Neither of them were wholly astray, but were soon met, and their progress stopped by the slow increase of the economy beyond certain limits, and by the practical difficulties arising in the pursuit of a partially apprehended law.

It is evident that we are limited as to the steam pressure, and that a great increase of that, or a great decrease of back pressure, by reason of more perfect vacuums, will render the point of cut-off so early, and the mean effective pressure so low, that the necessary increase of volume in the steam cylinder will prevent that compactness and concentration of power so desirable in the steam engine; and, although it has already been shown that high rotative speed aids in rendering the engine compact, we are also limited in that direction.

Regularity of speed is an imperative condition in all engines used to drive high-speeded machinery; under such circumstances, regularity becomes the first requisite, and to it all other considerations must be subordinated.

Mr. G. H. Corliss, with his automatic cut-off engine, was the first to satisfactorily solve this problem.

With a constant steam pressure and a constant load, an engine will run, under the control of a throttling governor, with an approximation to regularity determined by the sensitiveness of the governor. With a throttling governor every change of the steam pressure, every change in the load causes a change in the speed of the engine, no matter how well proportioned it may be.

The laws regulating the centrifugal governor are such as to prevent it from ever becoming a very perfect mechanism, for the engine *and governor* must go fast in order to go slow, and *vice versa*. With an automatic cut-off governor, the speed will be held with regularity under all steam pressures and loads within its capacity, the approximation to perfection attained being determined by the proportions of the fly-wheel and the sensitiveness of the governor.

Governors in which the inertia of the balls is utilized to check any attempted change of speed, without an appreciable change of speed in the governor itself, will ultimately supersede the centrifugal governor, which is full of radical defects.

Valve motions, actuated by a weight or spring released automatically by the governor, are comparatively so slow in their motions as to prevent high rotative speeds and short strokes. This form of valve motion has been elaborated with great skill and ingenuity on such engines as the Corliss, Harris-Corliss, Reynolds-Corliss, Wheelock's and Brown, which, so long as long stroke and slow rotation is adhered to, leave but little to be desired on the score of regularity of motion or perfection of workmanship.

To a different class belong the Porter-Allen and the Buckeye engines; in these engines, which are the exponents of high rotative speeds and short strokes, the cut-off of the engine is actuated by means of a link or an eccentric, whose position is regulated by means of a centrifugal governor, and, whatever the speed, the valves must keep pace with the engine in its motions.

A large number of valve motions are in use on the various forms of locomotive, marine and stationary engines, throughout the civilized world, and it is perhaps worth our while to practically note the important points of some of the older forms.

The plain hollowed slide valve is the most commonly used on the rougher forms of engines, because of its simplicity; as, however, the earliest point at which it can cut off steam without choking the exhaust is about ⅝ of the stroke, it is not economical with the high pressures of the present day or with the vacuums ordinarily attained in condensing engines.

When a reversing gear is used, the Stephenson link motion is commonly used, where simplicity of mechanism rather than economy of steam is a point to be gained.

With open rods it has a variable lead, decreasing from the dead point; with crossed rods it has a variable lead, increasing from the dead point.

For crossed rods, the position of the piston is nearly constant at the opening of the steam ports; this is a decided advantage. Crossed rods permit a slightly greater length of eccentric rods.

Fastening the link to the ends of the eccentric rods, at a point behind the centre line of the link, as is usually done in American practice, introduces irregularities into the point of cut-off, but does not affect the lead.

When the ends of the eccentric rods are fastened to the link, at points on the centre line of the link, this error does not occur, but larger eccentrics are required, which are sometimes inconvenient.

The mode of suspension of the link is far more important than is usually supposed, as imperfect suspension not only introduces serious errors in the valve motion, but also affects the durability of the construction, by producing excessive slip in the block.

Where a constant lead is desired, using different angles of advance for the two eccentrics will produce a constant lead in one direction of motion, but ruins the action of the valve motion in the opposite direction.

The Gooch link motion is difficult to fit into an engine, because of the distance required between the centre of the crank shaft and the end of the radius rod; it is very easy to handle, and should therefore be used where frequent reversing is necessary, as in the cases of yard locomotives and hoisting engines, even though requiring considerable trouble to fit in.

If a constant lead be a great advantage, this link motion has this advantage. The suspension link for the link proper should be made as long as possible, and the suspension link for the radius rod should be attached as closely as possible to the link block. The tumbling shaft should be placed on the opposite side of the link from the crank shaft.

Allan's link motion, having a straight link, can be more easily fitted up than motions having a curved link; it has all the disadvantages of the Gooch link motion, but, unlike it, has not a constant lead, and has a greater number of parts. Particular attention must be paid to the relative lengths of the tumbling shaft arms for simultaneously raising and lowering the link and radius rod. The Allan link motion does not handle as easily as the Gooch.

Heusinger von Waldegg's link motion is the easiest of all to handle; it can be so arranged as to have very little slip in the block, but cannot be easily attached to all forms of crosshead. It is the simplest reversing gear yet mentioned, and has a constant lead.

Pius Fink's link motion is the simplest reversing gear in existence which at the same time can be adjusted as a cut-off; it has a constant lead, but a limited range of action, and in this point is inferior to all the others, as well as being irregular in its variation from its calculated positions.

However, if carefully designed it will do good work, and is very easy to handle and very durable.

The fact that it is impossible to avoid choking the exhaust, and the consequent compression of the steam, thereby reducing the power of the steam engine whenever the attempt is made to cut off early in the stroke with a single valve has led engineers to devise double valve motions which will effect an early cut off of the steam, independently of the motion of the hollow of the slide valve relatively to the exhaust.

To this type belong the valve motions of the Porter-Allen and

Buckeye engines, both of which show a wide range of action for motion in one direction, and great simplicity of structure.

The Gonzenbach link motion, with its double steam chest, and excessively complicated outside gear, is now almost obsolete; it will not cut off sharply and well, except for very early points, and that, too, only for motion in one direction, and when properly arranged for motion in one direction gives a double admission of steam for motion in the opposite direction; it is difficult to handle, and its complication renders it very liable to break down.

The Polonceau link motion, while it has not the double steam chest or as much complication in its outside valve gear, cannot cut off steam later than $\frac{1}{3}$ of the stroke, and is therefore not very well adapted to general locomotive use where economy is sacrificed to concentration of power.

It is not very difficult to handle, but, like the Gooch, presents some difficulty in adapting to the narrow limits offered by a locomotive.

Meyer's link motion seems to have met with the greatest favour from builders of marine and stationary engines, as it presents a wide range for motion in one direction, and a greater range when used as a reversing motion than any of the others.

The screws which move the expansion blocks are liable to rust or wear, and cause trouble; the expansion valve should have separate eccentrics to work best; it is intricate in its construction, and liable to break down.

It is also difficult to handle, and absorbs much power unless the distribution valve is balanced.

An ingenious modification of the Meyer valve motion is the Ryder cut-off, in which a cylindrical expansion valve, whose edges approach each other after the manner of an isosceles triangle wrapped around a cylinder, is moved around its axis by means of the governor, so as to have the same effect as that of increasing or decreasing the distance between the expansion blocks of the Meyer cut-off.

In order that we may make ourselves clearly understood, we recapitulate.

A really good steam engine should possess the following qualities: Concentration of power, economy of steam, regularity of speed, simplicity of design and durability of construction.

We have endeavoured to mark the limitations of the first three attributes of a good engine; the last two must be worked out in the shop.

We are perhaps, too bold in our prediction, but it seems to us that the engine of the future will have a cylinder whose stroke is equal to its diameter, its speed will be limited by the tensile strength of its revolving parts, its bearings will be of great length, its cut off will be determined, approximately at least, by the ratio of the back pressure to the initial pressure, its valve motion will be rigidly in connection with the crank shaft, its reciprocating parts will be so proportioned as to put a nearly constant pressure on the crank pin, its fly-wheel, if it has one, will be proportioned so as not to admit of more than a predetermined variation of speed during one stroke, its governor will no longer be centrifugal, but a revolving pendulum, almost isochronous, and holding the engine, with all necessary approximation, within fixed limitations, to a constant speed.

ADVANTAGE will be taken of the refit of the *Shah*, which will be commenced on the 1st of April at Portsmouth, to provide her with an entirely new and much more powerful armament, but without increasing the number of her chase and broadside guns. The memorable engagement during which the *Shah* and the *Amethyst* permitted the Peruvian turret ship *Huascar* to slip through their fingers, as it were, has not apparently been forgotton at the Admiralty, and in her next commission the *Shah*, though the largest unarmoured frigate in the service, will be able to give a good account of herself in action against an ironclad. She has hitherto carried a couple of revolving 12-ton nine-inch chase guns, 16 six and-a-half-ton seven-inch broadside guns, and eight comparatively useless 64-pounders. In the new armament with which she is to be furnished, her heavy muzzle-loaders will be superseded by the new, long, and narrow B.L.R. weapons, of which she will carry two eight-inch and 24 six-inch guns; the 64-pounders being wholly dispensed with. For boat and saluting purposes she will be fitted with three M.L.R. nine-pound guns of 8 cwt. each, and one seven-pounder; and in addition to the above the *Shah* will be supplied with a couple of Gatling 45 machine guns' six Nordenfelt one-inch guns, and 12 14-inch Whitehead torpedoes. In the number and power of her armament the *Shah* will be one of the most formidable cruisers afloat.

ON THE EXPERIMENTS WITH THE PERKINS MACHINERY OF THE STEAM YACHT "ANTHRACITE."

From the Journal of the Franklin Institute.

By Chief-Engineer ISHERWOOD, United States Navy.

(*Continued from page* 280.)

IN calculating the weight of steam accounted for by the indicator at the point of cutting off the steam in the small cylinder nothing is to be added for condensation in the cylinder due to transmutation of heat into the total power developed up to that point, the heat for that purpose having been expended in the boiler during the generation of the steam. After the closing of the cut-off valve in the small cylinder all the steam thenceforth used to the end of the stroke of the piston of the large cylinder is expanded steam.

In calculating the weight of steam accounted for by the indicator at any point, from the steam pressure there present, allowance must be made for the weight of steam already in the clearance and steam passage of the cylinder when the boiler steam enters, as only the excess over this weight has been drawn from the boiler. The weight of steam in the clearance and steam passage present when the boiler steam enters is calculated from the back pressure against the piston at the commencement of its stroke, and not from the mean back pressure during its stroke. This is why the back pressure at the commencement of the stroke of the pistons is given separately in the table.

The economic results are given for the cost of the indicated, net and total horse-power in pounds of coal, in pounds of the combustible portion of the coal, in pounds of feed water, and in Fahrenheit units of heat consumed per hour. Of these, the latter alone is exact for comparison with the performances of other engines. The cost in pounds of feed water does not include the difference in the total heats of steam of different pressures, and in the total heats of feed water of different temperatures, which the cost in units of heat does. The cost in fuel is variable with the quality of the fuel, with the rate of its combustion, with the kind and proportions of boiler in which it is consumed, and with the skill of the fireman; the fuel measure is therefore not a proper one for the economic efficiency of the engine, *per se*, as compared with that of other engines, for which purpose it furnishes but a rough approximation. The true engineering comparison is for the cost of the *total* horse-power in units of heat consumed per hour. For commercial purposes the comparison should be for the cost of the *net* horse-power in units of heat consumed per hour. The total horse-power representing the entire work done by the steam, both usefully and in overcoming prejudicial resistances within the machine itself, while the net horse-power represents only the work done at the crank pin, which is the useful work available for purposes exterior to the machine itself. The number of Fahrenheit units of heat expended per hour per indicated net and total horse-power developed by the engine, is the product of the multiplication respectively of the pounds of feed water consumed per hour per each of the said horse-powers by the number of units of heat put into that water, namely, the difference between the total heat of the boiler steam and the total heat of the feed water.

If the object be to compare the economic efficiency of two systems of machinery, as a whole, including engine, boiler, method of using the steam, &c., then the cost of the *net* horse-power developed in pounds of fuel consumed per hour is the proper measure, taking care that the fuel used is the same in both cases.

In the various calculations of the quantities in the following table allowance has been made for the different specific heats of water at different temperatures and under different pressures. Also for the different total and latent heats of steam of different pressures. All the steam in the cylinders was in the saturated state, as appears from the difference in the weight of steam accounted for at any point by the indicator and the weight drawn from the boiler.

All the various quantities observed during the experiment were carefully noted personally by experienced assistant engineers of the Navy under the supervision of the Chief Engineers composing the Board. The indicator diagrams were taken by these assistants with every precaution, the indicators having been previously tested, as were also the scales used for weighing the coal and its refuse. Every attention was given to have the results minutely accurate. The cylinders, on trial, showed no leakage, and it is believed the entire machinery was in excellent condition.

Table containing the Data and Results of the Experiment made at the New York Navy Yard on the Machinery of the Steam Yacht "Anthracite" by a Board of United States Naval Engineers.

	Date of experiment (vessel secured stationary to wharf)	August 13, & 14, 1880.
	Number of sets of indicator diagrams, taken half-hourly	48·
Total Quantities.	Duration of the experiment in hours and minutes, consecutively	23.58
	Total number of pounds consumed of Cumberland semi-bituminous coal	4400·
	Total number of pounds of refuse in ash, clinker, &c., from the coal	776·
	Total number of pounds of combustible (gasifiable portion of the coal), consumed	3624·
	Per centum of the coal in refuse of ash, clinker, &c.	17·6363
	Total number of pounds of feed water pumped into the boiler	35114·
	Total number of double strokes made by the pistons of the engine	148154·
Engine.	Steam pressure in the boiler, in pounds per square inch above the atmosphere	316·50
	Steam pressure in the receiver, in pounds per square inch above the atmosphere	10·54
	Position of the throttle valve	Wide open.
	Fraction completed of the stroke of the piston of the 1st cylinder when the steam was cut off	0·5206
	Fraction completed of the stroke of the piston of the 3rd cylinder when the steam was cut off	0·2835
	Number of times the steam was expanded	25.7098
	In none of the cylinders was the steam cushioned, nor was there either steam or exhaust lead	
	Vacuum in the condenser, in inches of mercury	26·75
	Height of the barometer, in inches of mercury	30·023
	Back pressure in the condenser, in pounds per inch above zero	1·6066
	Number of double strokes made per minute by the steam pistons	103·02782
Temperatures.	Temperature, in degrees Fahrenheit, of the external atmosphere	77·5
	Temperature, in degrees Fahrenheit, of the engine-room	98·5
	Temperature, in degrees Fahrenheit, of the injection, or sea water	76·0
	Temperature, in degrees Fahrenheit, of the discharge water	95·0
	Temperature, in degrees Fahrenheit, of the hot well	122·0
	Temperature, in degrees Fahrenheit, of the feed water in the tanks	120·5
	Temperature, in degrees Fahrenheit, of the steam in the boiler, considered as saturated	420·0
	Temperature, in degrees Fahrenheit, of the steam in the 1st cylinder at the commencement of the stroke of the piston, considered as saturated	385·0
Rate of Combustion.	Pounds of coal consumed per hour	183·5883
	Pounds of combustible consumed per hour	151·2101
	Pounds of coal consumed per hour per square foot of grate	11·9869
	Pounds of combustible consumed per hour per square foot of grate	9·8728
	Pounds of coal consumed per hour per square foot of outer heating surface	0·6115
	Pounds of coal consumed per hour per square foot of inner heating surface	0·8142
	Pounds of combustible consumed per hour per square foot of outer heating surface	0·5036
	Pounds of combustible consumed per hour per square foot of inner heating surface	0·6706
Steam Pressures in 1st Cylinder per Indicator.	Pressure on piston of 1st cylinder at commencement of its stroke, in pounds per square inch above zero	201·64
	Pressure on piston of 1st cylinder at the point of cutting off the steam, in pounds per square inch above zero	169·12
	Pressure on piston of 1st cylinder at the end of its stroke, in pounds per square inch above zero	91·50
	Mean back pressure against piston of 1st cylinder during its stroke, in pounds per square inch above zero	45·95
	Back pressure against piston of 1st cylinder at commencement of its stroke, in pounds per square inch above zero	39·57
	Indicated pressure on piston of 1st cylinder, in pounds per square inch	110·98
	Net pressure on piston of 1st cylinder, in pounds per square inch	108·98
	Total pressure on piston of 1st cylinder, in pounds per square inch above zero	156·93
Steam Pressures in 2nd Cylinder per Indicator.	Pressure on piston of 2nd cylinder at commencement of its stroke, in pounds per square inch above zero	60·60
	Pressure on piston of 2nd cylinder at the end of its stroke, in pounds per square inch above zero	31·30
	Mean back pressure against piston of 2nd cylinder during its stroke, in pounds per square inch above zero	31·06
	Back pressure against piston of 2nd cylinder at commencement of its stroke, in pounds per square inch above zero	30·20
	Indicated pressure on piston of 2nd cylinder, in pounds per square inch	10·537
	Net pressure on piston of 2nd cylinder, in pounds per square inch	8·537
	Total pressure on piston of 2nd cylinder, in pounds per square inch above zero	41·597
Steam Pressures on 3rd Cylinder per Indicator.	Pressure on piston of 3rd cylinder at commencement of its stroke, in pounds per square inch above zero	27·71
	Pressure on piston of 3rd cylinder at the point of cutting off the steam, in pounds per square inch above zero	22·28
	Pressure on piston of 3rd cylinder at the end of its stroke, in pounds per square inch above zero	9·55
	Mean back pressure against piston of 3rd cylinder during its stroke, in pounds per square inch above zero	4·21
	Back pressure against piston of 3rd cylinder at commencement of its stroke, in pounds per square inch above zero	3·74
	Indicated pressure on piston of 3rd cylinder, in pounds per square inch	12·457
	Net pressure on piston of 3rd cylinder, in pounds per square inch	10·457
	Total pressure on piston of 3rd cylinder, in pounds per square inch above zero	16·667
Boiler Vapourization.	No. of pounds of water that would have been vapourized in the boiler had the feed water been supplied at the temperature of 100 degrees, and vapourized under the atmospheric pressure of 29·92 inches of mercury	36509·6289
	No. of pounds of water that would have been vapourized in the boiler had the feed water been supplied at the temperature of 212 degrees, and vapourized under the atmospheric pressure of 29·92 inches of mercury	40775·4371
	Pounds of water vapourized from 100° Fahrenheit by one pound of coal	8·2976
	Pounds of water vapourized from 100° Fahrenheit by one pound of combustible	10·0744
	Pounds of water vapourized from 212° Fahrenheit by one pound of coal	9·2671
	Pounds of water vapourized from 212° Fahrenheit by one pound of combustible	11·2515

(*To be continued.*)

To the Directors of the Perkins Engine Company, Limited.

GENTLEMEN :—In accordance with your desire, as communicated through Mr. Loftus Perkins, I, on Saturday the 22nd May, made a trial of the Perkins patent engine fitted on board the screw steam yacht *Anthracite*, preparatory to her leaving England on her voyage to New York.

You are of course perfectly well aware of the nature of the engines and boilers of the *Anthracite*, but in order that this report may be more readily followed, I think it well to state, in the report itself, the leading particulars of the machinery of that vessel.

The engines are of the direct-acting inverted type with surface condensation. Two cylinders only are used, but the after cylinder has two diameters of bore; the upper and smaller one is the high pressure, and receives the steam from the boiler during the first half of the down stroke, the lower and larger diameter, is the medium or intermediate, and is supplied at the up stroke with the steam, which in the high pressure did the work of the preceding down stroke. The exhaust from the bottom of the after cylinder passes into a chamber, from which is afforded the supply to the low pressure (the forward) cylinder, and from this arrangement there is obtained in two cylinders an expansion of thirty-two times.

The distribution of the steam in the after cylinder is made by three lifting double-beat valves, the upper faces of these valves being, however, divided into two sections. The valve stalks rise and fall by the action of eccentrics, which control the motion of the stalks downward as well as upwards, the stalks being loose in close-topped sockets in the valves, so that after the valves are seated the stalks can recede from them. The distribution of the steam to the low pressure cylinder is made by an ordinary slide valve with an expansion valve on its back; this latter valve is worked off the prolongation upwards of the circulating pump rod. The surface condenser is composed of a number of close-topped, galvanized, wrought-iron tubes, standing vertically from a tube plate, and having within them smaller tubes open at both ends, and proceeding upward from a lower tube plate, so that the water from the sea passes up through the central tubes, and down the annular spaces to the inlet of the circulating pump.

The exhaust steam is admitted into the body of the condenser, and comes into contact with the exterior of the close-topped tubes, the condensed steam being drawn off by the air-pump, and returned to the hot well which surrounds the upper part of the condenser. The space between the high pressure piston and the upper side of the intermediate piston is in connection with the chamber which supplies the low pressure cylinder. The circulating pump is worked by a beam off the low pressure piston rod, and the air-pump is worked by a similar beam off the intermediate cylinder piston rod. The feed pumps and bilge pumps are worked off the cross heads of the circulating pump and of the air-pump. The reversal is effected by a link motion.

The cylinders and their covers are heated by steam circulating through wrought-iron pipes cast into the thickness of the metal, and are very efficiently clothed so as to prevent loss of heat.

The boiler is the well known Perkins boiler formed of successive horizontal rows of wrought tubes (3 inches external diameter) connected at frequent intervals by vertical thimbles, the whole series being contained in a wrought-iron double casing having the space filled in with vegetable black. The water gauges, one in the boiler and one in the engine room, are made of flat plates of mica secured in frames. The boiler is supplied with distilled fresh water. There is a still fitted with a coil, and having its steam pipe in connection with the condenser, by which the store of water can be distilled over for use.

With respect to the dimensions of the engine, I was furnished at my request by Messrs. Hawks, Crawshay & Sons, the builders of the engines, with the working drawings. These drawings show the high pressure cylinder to be 8 in. bore, the intermediate 16 in. bore, and the low pressure 23 in. bore, but I was informed by Mr. Perkins that the cylinders were all somewhat smaller than the foregoing dimensions. He has now sent me the gauges, and these give the high pressure cylinder at $7\frac{3}{4}$ in. diameter, the intermediate as $15\frac{13}{16}$ in., and the low pressure as $22\frac{13}{16}$ in. The stroke in both cylinders is 1 ft. 3 in. The diameter of the piston rods (the areas of which have to be deducted from the area of the intermediate piston, and from that of the underside of the low pressure piston) is $2\frac{3}{4}$ in.

My principal assistant was on board the *Anthracite* on the Friday, and he informed me that the fire was let out at about 2.30 p.m. on that day, and as the result the boiler and water were practically cold when the fire was lit on Saturday morning.

Preparations for the trial had been made by weighing out 50 cwt. of "Nixon's navigation hand-picked lumps" into fifty 1 cwt. sacks. These were ranged on deck. The bunkers, which were full, were sealed up both above and below. A spring balance was hung up on deck, close to the stokehold hatch, and one of my assistants caused each sack of coal to be reweighed just before it was lowered for use. The gross weight was taken, and the sacks were afterwards separately weighed so as to obtain the net weight of the coal.

Fifty pounds of dry wood were served out and two sacks of coal, and with these the fire was laid (the grate has an area of about 15 square ft.). The fire was lit at 6.28 a.m. Steam was up and the engines were turned round at 7.18 a.m. The height of water in the boiler gauge was noted, and also the height in the hot well, the still cock being shut, was sealed in that position. The steam stop valve was sealed in its wide open position. The engines were started, and the vessel got under way at 7.20 a.m. The throttle valve was put into the position which the engineer knew, from experience, would cause the engines to run at about 130 revolutions per minute after they became thoroughly heated up, and the handle was sealed into this position, the link motion being in full gear ahead. The engines were provided with a Harding's counter, such as is used in the Navy, and there were pressure gauges to show the boiler pressure, and the pressure in the chamber supplying the low pressure cylinder, and the condenser was provided with a vacuum gauge. Four Richard's indicators were fitted, viz.: one to the high pressure end of the after cylinder, one to the intermediate end of that cylinder, one to the top and one to the bottom of the forward, the low pressure cylinder.

The first set of diagrams was taken at 8.22 a.m. The first reading of the counter at 8.30 a.m. From this time until 5.45 p.m. the counter was read at the hours and half hours, and sets of diagrams were taken at the quarter past the hour, and at the quarter to the hour. The time when each sack of coal was lowered into the stokehold was noted, and also the time when the stoker commenced to use the contents of each sack.

The last shovelful of the fifteenth sack was put on at 5.18 p.m., and it was decided to stop the trial as soon as the coal then in the fire was exhausted.

I determined to let the engines run on until they stopped of themselves, and to take indicator diagrams, first at each quarter of an hour and then at each five minutes during the time they were gradually stopping. The quarter hour diagrams were taken until 6.30 p.m., when the engines were making 124 revolutions, and the five minutes diagrams were taken until the engines came to a stand at 7.23 p.m. or 12 hours 3 minutes after their start in the morning. The water in the boiler was pumped to the same level in the gauge as that at which it had stood in the morning and the height of water in the hot well was noted.

The mean revolutions from 8.30 a.m. to 6.30 p.m., 10 hours, were 130·77 per minute, and from the first start to the same time being 11 hours 10 minutes, the mean revolutions were 130·4 per minute.

An experiment was made as to the transmission of heat through the boiler casing. This was carried out by placing the bulb of a thermometer in contact with the top of the casing, the bulb being covered over with cotton waste; the result was that at the end of one hour the thermometer stood at 125 degrees Fahr.

From the start at 7.20 a.m. to 6.30 p.m., 11 hours and 10 minutes, the engines developed an average gross indicated horse-power of 80·55, but from 6.30 to the time, 7 23 p.m., that the engines stopped of themselves from the fire having burnt itself out, the power was of course gradually diminishing. This being so I have calculated the whole work from first to last in foot-pounds; these amount to 1,828,291,466 foot-pounds, equivalent to 923·38 horse-power if exerted for one hour.

I estimate the 50 pounds of wood as of about one-third the value of coal as fuel, say ...	17 lbs.
The coal 15 cwt.	1680 „
	1697 „

The gross indicated horse-power developed during the trial being equivalent to 923·38 horse-power exerted for an hour 1697 ÷ 923.38 = 1·83 pounds of coal per horse-power per hour, *including the coal used in getting up steam.*

As a check upon the foregoing from the time when the first shovelful of the fourth sack of coals was put on the fire, namely, at 7.50 a.m. to the time when the first shovelful of the fifteenth sack of coals was put on the fire, namely, at 4.45 p.m., *i.e.*, 8 hours 55 minutes, the engines exerted an average of 80·9 horse-power; this gives the consumption per horse-power per hour at 1·7 pounds, assuming the fire was uniform at the commencement and end of these times. The loss of water for the whole 12 hours was $23\frac{1}{3}$ gallons.

The engines worked with the most remarkable smoothness and regularity, as with the exception of tightening up the bolts of two glands about an hour after the start, there was not a spanner or hammer or any tool used about the engines during the 12 hours the ship was under way, nor was there a single handle connected with the engines shifted. The link-motion was in full gear the whole while, and the stop valve and throttle valve remained, as I have said, sealed up and unmoved.

Water was allowed to circulate on the thrust-block, but there was not a heated bearing anywhere. The amount of lubrication was small, involving an expenditure of about one gallon of lard oil, while cylinder and slide lubrications are in the Perkins system inadmissable and with the metal used unnecessary.

The engines were thoroughly steady, no straining or racking of any kind, in fact it is impossible for any pair of engines to have worked in a more thoroughly satisfactory manner, so far as all external evidence of working was concerned, and there were no sounds to lead to any other belief than that of all being satisfactory within.

I hope on the return of the *Anthracite* from America to have an opportunity of seeing the engines opened, and of thus observing their condition after some thousands of miles of steaming, and I should also be glad to have an opportunity of retesting the consumption.

At the conclusion of the trial my assistants took away the four indicators and the spring balance with which the coals were weighed. All these have been tested with the result that the balance and the 100 pound spring (used in the high-pressure cylinder indicators) and some of the lighter springs, are absolutely accuate, and that the variations in the others are too trifling to call for any allowance in calculating the mean pressures.

It may be well to state that the mean pressures of the various diagrams (of which there were 128 in all) have been ascertained by dividing the areas of the diagrams, obtained with the planimeter, by the lengths of the diagrams. This is a thoroughly accurate mode, while the plan commonly followed of measuring the heights of the diagrams at a number (usually ten) of places is one which ordinarily gives a pressure in excess of the truth.

It would be an investigation of considerable interest in an engineering point of view if a vessel fitted with first-rate compound engines of the ordinary construction, and working, say, at 70 pounds pressure in the boiler and indicating something about the same power as those of the *Anthracite*, viz., from 70 to 90 horse-power, could be tried in a precisely similar manner to that in which the *Anthracite* was tried.

In conclusion, I wish to say that I esteem myself particularly fortunate in having obtained the friendly co-operation during the run of Mr. William Rich, of Messrs. Eastons & Anderson, whose long experience in engine trials rendered his assistance of the greatest value, and to whom I beg leave to express my best thanks. I have his authority for saying that he entirely concurs in this letter of report.

I am, gentlemen, your obedient servant,
(Signed) F. J. BRAMWELL.

THE programme of the meetings of the Institution of Naval Architects, which takes place on the 6th, 7th, and 8th of April, is lengthy and varied. There will be no less than sixteen papers on the theory and practice of naval architecture and on marine engineering. There are to be four papers on a subject which is exciting much attention, viz., the use of mild steel in substitution for iron as a material for the construction of the hulls and armour of ships, the shells of steel boilers, and parts of the machinery. Mr. Samuda will deal with the application of steel to the construction of war ships. Mr. W. Parker, chief engineering surveyor to Lloyd's Registry, will treat on the failure of the original steel plates used in the boilers of the *Livadia*. The best steel has occasionally behaved most treacherously, and Mr. Parker's paper is expected to throw considerable light on this subject. The third paper on steel is by a well-known French authority, M. Berrier Fontaine, who will give an account of the experience of the French dockyards in the use of mild steel for shipbuilding. The fourth paper is by Mr. J. R. Ravenhill, on the increasing use of steel for shipbuilding and marine engineering. Of the papers on theoretical naval architecture Mr. W. H. White, of the Admiralty, will contribute two. Mr. R. E. Froude will deal with a subject with which his late father's name was identified, viz., the leading phenomena of of the wave-making resistance of ships. Finally, Mr. W. John, of Lloyd's Registry, will read a paper on grain cargoes, a matter to which the loss of many grain-laden vessels gives a painful interest.

ROCKET LIFE-SAVING APPARATUS.

THE last report of the Chief of Ordnance to the United States Government contains, amongst a vast amount of interesting matter, a valuable report by Lieutenant Lyle on life-saving rockets, based on a series of experiments carried out at Sandy Hook last year, with a number of Russian, German, and English apparatus. The Russian rocket consists of an iron cylindrical case 3 in. internal diameter and 27.2 in. long, closed at the head by a hemispherical metallic cover, and at the rear with an iron plate provided with a screwed socket and a series of small vent holes. The stick is of light wood, 27 in. long, with a screwed head for attaching to the rocket body, and near the opposite end on the under side is a light steel hook for engaging in the chain when the rocket is fired. The total weight of the apparatus is 25.5 lb. The firing tube is rectangular in section, about 50 in. long, and formed of thin sheet iron, bent so as to have on the lower side two parallel flanges or projections in such a manner that the tube has a slot running along the whole length of the tube on one side, except for a few inches at the rear end where it is strengthened. This tube is mounted on a graduated quadrant placed on a tripod. On being fired the hook on the underside of the rocket-stick slides in the groove just mentioned, and in emerging engages in the end of a short chain hung outside the muzzle of the tube. This chain is connected to the safety line.

There are two descriptions of German rockets, one resembling in general appearance the Russian rocket just described. It is made in two sizes, and consists of an iron cylindrical case fitted with a solid ogival head, the butt end of which fits within the case, and is fastened to it by screws. The rear end of the case is reinforced by an internal ring and an open casting is also screwed to it; this casting, which extends about 8 in. to the rear of the case, is cylindrical, but with the metal cut away except at the ends, which are connected by three ribs, parallel axially and converging to the rear end, which contains a socket for the stick to be screwed into. The latter is of wood, coned at the front end and covered with sheet iron, a screw being introduced for attaching it to the case, and the rear end is provided with an iron loop through which the chain is passed. The following are the dimensions of the leading parts of the 2 in. and 3 in. rockets of this class:

	2 in. Diameter. in.	3 in. Diameter. in.
Body:		
Total length of rocket	23·5	34·5
Length of case	15	
Inside diameter	2·05	3·1
Thickness of case	·05	·06
Length of head	5·2	8·75
„ base ring	1·1	1·35
Total length of base	5·8	8·3
Number of ribs	3	3
Stick:		
Total length	39·4	39·9
Largest diameter	2·2	2·3
Smallest „	2·0	2·0
Length of chain	87·	122·5
Weight of rocket complete	15·5 lb.	42·25 lb.

The German anchor rocket is very similar in general form to those just described. Instead, however, of the head being ogival it is formed with four short arms and flukes; the base piece is tripoidal and not cylindrical, but is made with three ribs and open spaces between them, and the stick is of thin sheet metal formed into a tube about 2·3 in. in diameter. The German rocket stand consists of an open sheet iron trough 12 ft. 9 in. long, and trapezoidal in form with a rounded bottom, in which at the front end a slot 1 in. wide and 10·9 in. long is formed for the chain to pass through. The upper edges of the trough are stiffened with angle-iron, and along the bottom from the slot before mentioned to 10 in. beyond the rear end of the trough, a stiffening plate is bolted. To the projecting extremity of this bar two small inclined stays are attached. The stand is supported by two inged legs near the front end of the trough, and by the projecting bar at the rear end, which rests on the ground. The rocket is ignited by a percussion snap lock.

The English Boxer rocket differs from any of the former already described. The body is made of two Bessemer steel cylinders placed end to end in the same axial line. Both cylinders are charged with composition in such a way as to leave in each a conical cavity which reaches to within four inch of the forward ends of each case these ends being filled in solid with composition. The front end of the forward case is closed with a semicircular metal head, and the rear ends of each with a ring, leaving a circular opening one inch in diameter in the centre. The two cases are secured together by screws passing through a diaphragm with a central opening, and placed between the front of one cylinder and the rear of the other. Metal straps pass round the cases, and are extended on one side to receive the stick, which are of pine, nine feet six inches long, one-and-a-quarter inch square, and protected beneath the vent of the case by a sheathing of tinned iron. Holes are made in each, and axially for some distance, and then curved till they pass through the stick for the reception of the line. The stand is of sheet iron, except the legs, which are of wood, and is something like the German form. The Boxer fuses are conical, one-and-a-half inches long and one inch in the largest diameter, to fit the opening in the vent. The object of forming the body of this rocket in two parts is to give it additional range, the charge in the forward case igniting only after that in the rear case has burnt out.

Finally, we may mention the Hooper rocket, a metallic cylinder 3.75 inches in diameter and fourteen-and-a-half inches long, closed at one end by a spiral wooden head and at the other by a metal base extending several inches beyond the rear of the case, and furnished with a number of spiral springs through which the gases escape and impart a rotary movement to the rocket. No stick is attached to this apparatus and the chain is linked to a swivel on the base.

By way of comparison, we may notice one form of life apparatus in use in America. This is a solid shot, twelve inches long and two-and-a-half inches in diameter, with an ogival head. The base is recessed and tapped, and into it is screwed a hollow cap. To flanges on the rear of this cap are pinned five arms or flukes 83 inches long and 25 inches thick. These are connected by rigid horizontal arms, at a point two inches below that where they are pinned to the cap, to a central bar thirteen inches long and about five-eighth inches diameter; one end of this bar is made with an eye, and the other end is screwed and a nut is placed on it. This nut slides in a part of the opening within the cap, the diameter of the remainder being only sufficient to allow the passage of the bar, except in one place where it is slotted out to receive a locking spring. When the flukes are closed around the central bar, the nut on the end of the latter is pressed inwards, but when the flukes are opened, the nut and bar move forward until the former is stopped by the shoulder in the cap, and at the same time the spring-catch before mentioned locks the flukes open. This projectile is fired from a gun having a bore two-and-a-half inches in diameter and twenty inches long; it is placed in the gun point downward, with the flukes closed; but after being fired the shot reverses, and the pull from the rope fastened to the eye at the end of the central bar drives back the latter, opening the flukes until they are locked in their extended position.

The result of a large number of experiments made with the Russian, German, and English systems of rockets are given in Lieutenant Lyle's report, and the conclusions he draws from them may be summarised as follows. He found that the Russian rockets were extremely unwieldly, and that they and the stand were very inconvenient to handle. The mode of picking up the chain at the commencement of the flight is objectionable, as a sudden strain is thrown upon the chain, sufficient sometimes to break it. The construction was very faulty, and many of the rockets failed through blowing out the base, which is weakened by a large number of vent holes. The range and accuracy obtained left much to be desired. The German rockets gave excellent results in both the latter respects, moreover none of them failed, and the workmanship was extremely good; the stand also left nothing to be desired. The drawback to the system is its costliness; the smaller-sized rockets cost about 15s. each, the large size about 23s., and the anchor rockets nearly £5. Nevertheless these rockets are preferred on the New Jersey coast to any other, although the confidence in them is not sufficiently great to encourage the men to stand near when they are fired. The Boxer rocket is reputed to be erractic in its flight, and very easily deviated from its course by wind; it is also considered too complicated for use on the American coast. The Hooper rockets are stated to have failed very badly, and to be liable to explode dangerously. Lieutenant Lyle concludes his report by pointing out that the greatest possible care is required in packing, storing, and handling rockets; the composition is very liable to get loose from the case, and when fired gases find their way into the spaces thus left, often producing an explosion. Under the most favourable circumstances "it may be said that with rockets one never knows what may happen, nor where they will go when fired."—*Engineering.*

IMPROVED BOAT LOWERING APPARATUS.

THERE has been so much agitation about efficient means for lowering boats safely at sea, that it is to be expected that some means will be eventually and generally adopted. We illustrate herewith a boat lowering apparatus, the property of the British and Foreign Boat Lowering Company, Limited, 5, Austin Friars, Old Broad Street, which seems to have many valuable features to fulfil all the requirements of the investigating committee on the accident to H. M.'s steam frigate *Ariadne*. In their report the following requirements and qualifications for an efficient apparatus were recommended.

1. The arrangements should be of the most simple character, and readily understood by untrained men.

2. The apparatus should be always in readiness for immediate use.

3. The lowering and disengaging gear should be certain in their action and under the absolute control of one man.

4. It should be possible to lower both ends of the boat simultaneously.

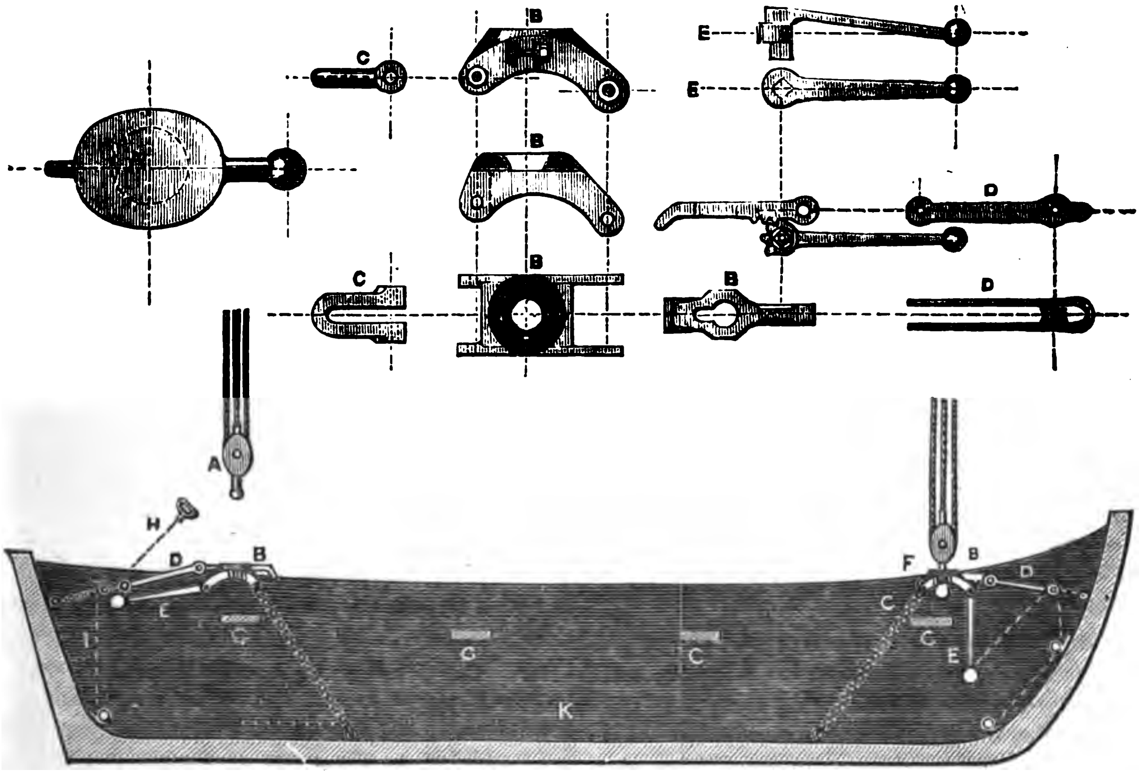
5. The disengaging operation should be easily and quickly performed.

6. There should be no risk of fouling, nor of the persons in the boat being injured by the falling of the heavy gear.

7. The lowering gear should be in conjunction with the hoisting pendants, or easily and quickly attached to them.

All these points are amply fulfilled by the Company's Patent gear, and at the same time, as all the improvements are added in the boats and to the block on the falls, the usual falls and davits require no alteration. This is a great consideration in applying a new improvement, as the first cost is thereby considerably reduced and the shipowner sees that if not satisfied he has but to remove the new gear and his old tackle is as good as ever.

In reference to the illustration the forward fall is shown locked and secure, and the after fall is disengaged. The peculiarity of the fall block is that it terminates in a nob, not in a hook. This is a great advantage in a rough sea as such accidents frequently occur by the catching of the hook in the thwarts, chains, or persons of those on board. The difficulty of releasing a hook at any moment is very great when the boat is unsteady and is alternately light and bearing hard on the hook. The nob of the bolt attached to the block A passes through a circular collar B, through which passes a slotted bolt B. The slot in this bolt is as small in one part as the shank of the ball block, and in another part sufficiently large to let



IMPROVED BOAT LOWERING APPARATUS.

the nob pass through it. In small boats the chain-slings are arranged (as shown in the drawing) so that the weight of the boat assists in locking the ball-block. In heavy boats both chains are fixed to the frame of the machine, and when fixed for hoisting the sliding bolt is fixed to the box by means of a pin passing through both.

Where practicable, the simplest plan is to fix the machine under a thwart and bolted to the keel, this doing away with all sling-chains. This bolt is provided with teeth as a rack, into which gears a partly toothed pinion on the end of the ball lever E. When the ball lever is hanging down, as at the forward end of the boat, the bolt locks the ball block, but as soon as the ball lever is raised as seen aft, the bolt B is thrust forcibly forward, and the ball block is allowed to escape. The raising of these ball levers can be effected simultaneously by one man sitting at the stern by means of the running chain K and the handles H and I, or either block can be released as desired.

The picking up of the boat is very easy by taking in one hand the block and lifting up with the other the ball lever, slipping the ball block into the opening and dropping the lever. This operation is performed instantaneously, and when locked it is impossible for any rising or falling of the boat to disengage the ball block and fall. But at the same time the man locking the ball can instantaneously release it if he finds the man at the other end of the boat has failed to lock; thus preventing the boat being left hanging end on by a receding wave.

Another great advantage of the ball block above hooks of any kind is that in case of any foul of the fall ropes whilst hoisting, the nob of the ball block will turn in its socket, and thus relieve the twist or foul.

The gear can be fixed or removed immediately by inserting or removing the pins at the foot of the stay rods and fixing or unhooking the sling chains.

They have just fitted the boats of the *Garth Castle*. On March 26th their gear was tried before a good company, and under the personal superintendence and orders of the captain (Captain Webster), with great success. Captain Small (Messrs. D. Currie & Co.'s superintending captain) was also present. On one occasion the boat was let off about 4 feet from the water, with six men in her, and also oars, sails, two barrels water, &c., the gear acted splendidly. Messrs. Scrutton & Co., who are manufacturing for the Company was present, and all seemed pleased at the results acheived.

IMPROVED FOG HORN.

As the danger to vessels during fogs is by no mean on the decrease any apparatus that promises additional security well deserves the consideration of our readers.

The horn is one of the best means of giving a distinct warning sound during the continuance of a fog. We consider a horn better than a bell, as it gives a definite direction to the sound. A bell gives a sound equally in every direction, and does not thus convey the distinct idea of position produced by the blast of a horn, which proceeds only in one direction. In sailing vessels where there is no steam on board it is impossible easily to produce a fog horn signal. The apparatus we illustrate is a simple mechanical means of producing a blast through a horn. The trumpet A is of the usual form, and at the larger end is provided a conical disperser, sustained in place by radial arms. The smaller end of the trumpet is inserted in the chamber C, and is provided with a reed B.

The chamber C communicates with the air cylinder F, whose piston is moved by means of a handle at the end of the piston-rod, projecting from a stuffing box at the end of the cylinder. Air enters at either end of the cylinder through valves 6, and is forced through a passage containing a check valve into the air chamber C.

The resulting blast is clear and sonorous, and the apparatus thus appears very efficient for sailing vessels.

THE MAMMOTH FIRE BOAT.

A very large proportion, fully one-half of the whole number of fires in New York and Brooklyn occur at the river side. As most of the buildings there are of excessive height it has been found that the ordinary fire appliances are quite unable to cope with the fires. A gigantic fire boat has been designed for this purpose by a Mr. Maxim, of sufficiently large power to flood out and almost instantly extinguish any fire that could possibly occur. This would no doubt prove a very remunerative outlay, although the cost will be large, in the great amount of salvage thus saved.

The boat is of iron, 250 ft. long and 40 ft. beam. She is driven by paddle-wheels, which have each their independent engines, so that the boat can turn as it were on a pivot. She carries 3,000 horse-power, all of which can be turned on to her paddle power or on to the pumping engines. The engines are compound, using steam at 80 lb. pressure per square inch. The pumps are of the compound duplex pattern, and are of great size and strength.

The novel features of this boat consist of the vertical stand pipe and the two discharge pipes mounted on trunnions on the stand pipe, one at the top and one at the bottom. The stand pipe communicates with the water pressure reservoir below deck, and will rotate in any direction, and will elongate or shorten by a telescopic joint.

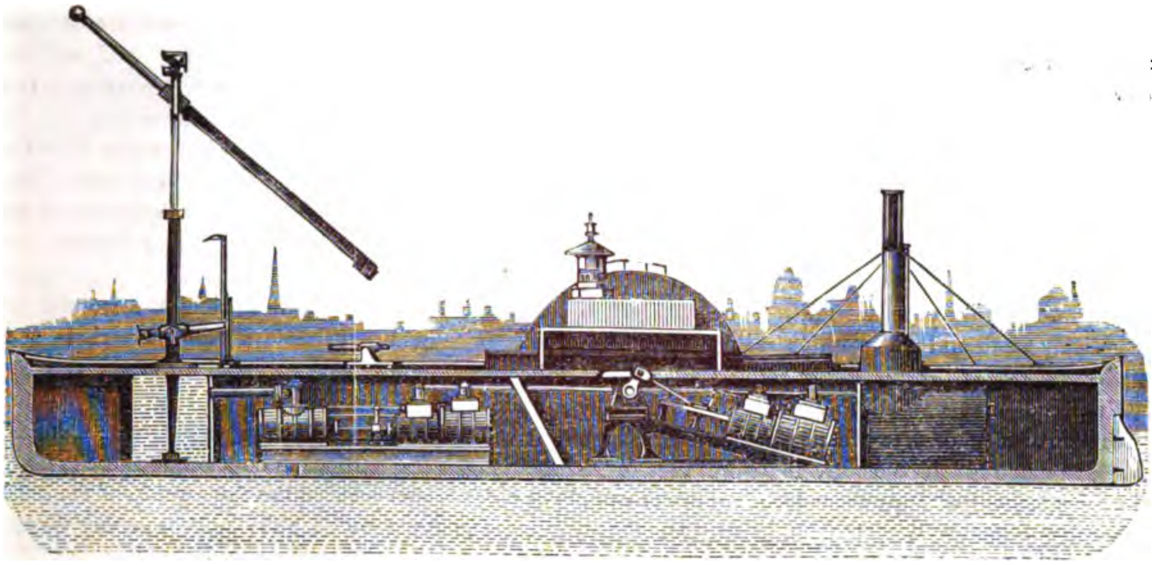
The lower discharge pipe is designed to extinguish fires on shipboard or for sinking a ship. It has a nozzle 20 in. diameter, and can therefore throw a stream 400 times greater than that of an ordinary 1 inch fire nozzle.

With the sea for a supply and 3,000 horse-power on the pumps, the stream would be that of a considerable waterfall of inconceivable force and magnitude. In the case of the upper nozzle the discharge is 60 ft. above the deck, and the nozzle is 60 ft. long from the trunnion. When at its highest angle of elevation the nozzle is 100 feet above the deck.

A very ingenious modification is used on the upper discharge pipe. A series of nozzles, five in number, varying in diameter from 6 to 10 in. are arranged in a rotating barrel like a revolver, and thus any variation in the size of the nozzle for short or long distances can be produced instantaneously without stopping the flow. In addition to the water appliances this boat carries a gun to demolish the walls of buildings when the fire cannot otherwise be got at. This gun is of special construction, 16 in. in the bore, firing a wooden projectile 4 ft. long.

THE NAVY ESTIMATES.

On Friday night Mr. Trevelyan moved the Navy estimates in a speech at once complete, modest, and lucid. It evoked very little criticism, although the sums for which Mr. Trevelyan asked are very large. Nor, indeed, is it easy to criticize a scheme which is in almost all respects admirable. Up to the present it has been constantly charged against Liberal Governments that they are invariably the reverse of liberal in dealing with the Navy; and that when they go out of office they leave the ships of which they have had the care in a miserable and dilapidated condition. It would seem from Mr. Trevelyan's speech that this objectionable charge cannot for the present at least, be brought against Mr. Gladstone's Administration. Not only does the present Board of Admiralty approve of what was done by its predecessors, but it goes further in the same direction, and announces that the Navy of England must be supreme, and that supremacy can only be obtained by taking advantage of all the aid that science can lend We are to have everything that is new provided it be



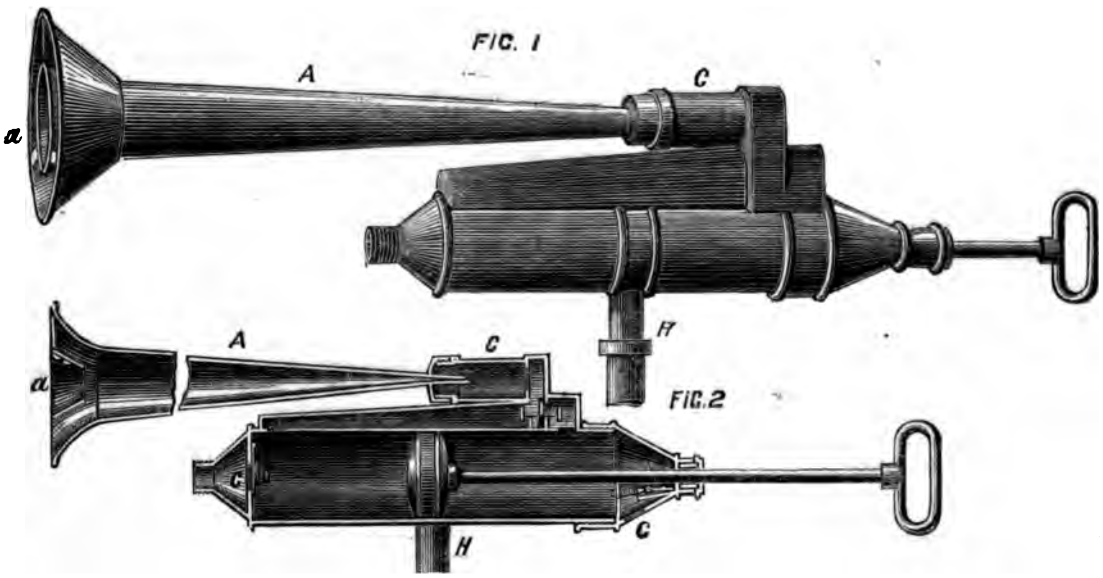
THE MAMMOTH FIRE BOAT (*see page* 12).

also good. Steel armour, breech loading guns, torpedoes, torpedo boats, machine guns, and electric lights are all to be pressed into the service of the Navy. The price to be paid will be high; but omelettes cannot be made without breaking eggs. The old estimate for first rates was £1,000 a gun. Thus the cost of the *Duke of Wellington* the last of the great three-deckers which have made England's flag glorious, including her machinery, did not exceed £150,000. In the present day we cannot get an ironclad fit to fight in line of battle for less than £400,000, and the price of such ships as the *Inflexible* far exceeds that sum. The Italians spend nearly a million on each of such ships as the *Duilio* and the *Lepanto*. To argue that the sums thus laid out in Great Britain are wasted, is to show that the questions at issue have not been fully grasped. Not less than one-half the whole mercantile marine of the world sails under the British flag, and relies for protection on British ships of war. Under the circumstances it is important that our Navy should be of adequate power. Money spent in rendering our merchant ships safe from pillage could not be regarded as wasted under any circumstances, so long as its expenditure secured the required end. But wholly apart from this consideration is another, which may well deprive the Navy estimates of their terrors. When we spend half a million on an ironclad, we really, as a nation, do not lose the money. John Bull takes it out of one pocket and puts it into another. To cite armour-plates as an example. In their production quite a small army of men is employed in raising coal, smelting iron, making bricks, and, finally, in producing the plates themselves. The construction of armour-plate mills and furnaces gives employment to yet other workers by the score. In making guns and ammunition Woolwich Arsenal keeps over 7000 hands employed, and in time of pressure as many as 13,000. In our dockyards thousands of men earn their living. Our engine builders, when they get orders from the Admiralty, are delighted. Not one sixpence need be spent out of Great Britain, which is absolutely self-sufficing in the matter of war-ships. Abroad it is different. France, Germany, Italy, have all to come to us for armour-plates, at least, and for much else besides. It may be urged that if we did not spend half a million on a ship, we could save that amount in taxes, which would do us more good. Perhaps the saving would amount to about 3½d. per head of the population, or in a family of seven to, say, two shillings, an appreciable sum; one as nothing compared to the advantages accruing to many hundreds of artisans employed in the construction of our navy. A modern English ironclad is not, therefore, as some would have us think, an embodiment of waste. There is more to be urged in her favour than the bald statement that, whether she does or does not represent money misspent, she is indispensable.

Those portions of Mr. Trevelyan's speech possessing most interest for our readers refer to three subjects, namely, the construction of new ships; the adoption of breech-loading guns in the Navy; and the pay and position of naval engineers. The programme of the

Admiralty for the coming year is easily stated. The *Agamemnon* and *Ajax* are to be completed for sea at Chatham; the *Inflexible* is to be commissioned in June or July; the *Conqueror*, an improved Rupert, is to be pushed on; the *Polyphemus* is to be completed; the *Colossus* and the *Majestic* will each be advanced about a quarter; the *Collingwood* will also have work done on her. So much for what may be termed old ships. The most noteworthy feature in the Admiralty scheme is the construction of ships of a new type. These will be partially-armoured cruisers, intended to cope with the second-class ironclads of other Powers, and to protect our commerce all over the world. Time was when comparatively small and cheap ships would have been deemed sufficient for the purpose. Sir E. J. Reed—then Mr. Reed—was carried to fame and fortune by designing small men of war which should have a high speed. He made his ships short, therefore they were small and handy. Making them speedy was the affair of the marine engineer, and Messrs. Penn, Maudslay, Ravenhill, Rennie, and others, gave Mr. Reed what he wanted. But the day of Bellerophon's is over, and the small ship of the epoch is described by Mr. Trevelyan in the following passage:—"Her length is to be 315 feet; her extreme breadth 61 feet; and her tonnage about 7,300. Her horse-power 8,000; her bunkers will hold 900 tons; and her speed on the measured mile will be sixteen knots. She has the great advantage of twin screws. She will have a belt 8 feet broad and 140 feet long amidships, of steel-faced armour, 10 inches thick with 10 inches of backing, protecting her engine-room and boilers 3 feet above water and 5 feet below. She will have a conning tower of steel-faced armour; a protecting deck of inclined steel, 3 in. thick, 5 ft. under water, covering the whole of that part of the ship, both fore and aft, which is not clad in iron. She will carry an armament of four 18-ton 9·2 inch breach-loading guns, mounted in barbettes, with protection against bullets, which at a thousand yards will pierce 16½ inches of iron armour, and more than 13 inches of steel-faced armour. She will carry likewise six 6-inch breech-loading guns, equal in range to those which carried desolation at a distance of five miles into the Peruvian harbours; she will be equipped with boat guns, torpedoes, machine guns, and will probably be fitted with a couple of torpedo boats in addition; and she will have room for over 400 men and officers to work her and fight her. She will combine the speed of the *Leander* with guns of greater power than the *Thunderer* or the *Devastation;* and the Admiralty with some confidence submit her to the criticism of a nation which thinks little of a vessel that cannot travel far and fast, and fight sharply and long. She will rank high among cruisers, and high among second-class ironclads, and in the hope that she will meet the ends for which she is designed, it is proposed to lay down one such vessel this year at Portsmouth, and another at Chatham. Her hull and engines will cost £400,000, as against £550,000 for the *Collingwood*, and £150,000 for the *Leander*. Later on we propose to confide the construction of another to a private yard. It is impossible within reasonable limits of space to attempt to criticise such a design as this; but we may point out that the adoption of comparatively light guns of enormous power has alone rendered such a ship possible. A comparatively small cruiser of 7000 tons displacement and 8000 horse-power may well excite the wonder of those who once held that the days of big ironclads were numbered. The new ship will hold a rank in the Navy not quite equal to that formerly held by the 74-gun ships. It will not be out of place to give, for the sake of comparison, a few particulars concerning these 74's. One, the *Ajax*, was perhaps the fastest ship of the kind under steam in the Navy after she had been cut down. She was 176 ft. long between perpendiculars, 48 ft. 6½ in. beam, and drew about 23 ft. Her displacement was about 3000 tons. The power of her engines, indicated, 846 horses, and her speed unrigged but ballasted, 7·147 knots. The *Blenheim*, another 74 cut down, was of nearly similar dimensions, and rigged and fully equipped for sea, had under steam a speed of 5·81 knots, obtained with 811 indicated horse power. It is not thirty years since these ships were regarded as powerful vessels, fit to go anywhere and fight anything afloat.

The Admiralty have finally, and we think prudently, determined to adopt breech-loading guns. In the art of constructing such things the world has made great progress within the last fifteen or twenty years; and whereas a 10 in. breech-loading gun, trustworthy and capable of firing a very heavy charge, was an unknown weapon as late as 1871, there can be no doubt now that such a gun can be produced. Comparisons have been drawn between the breech-loading guns of the French navy and our own muzzle-loaders, wholly to the disparagement of the latter. But this is wrong. The French naval breech-loader has already been illustrated in our pages. It is a gun of the past, powerful but in name, and the whole French navy will have to be re-armed ere long; and progress is being made in that direction. The great advantage of breech-loading is that it permits the use of a very long gun on board ships; and great length of bore is essential to give the enormous velocity which can alone enable a comparatively light projectile to get through a great thickness of armour. It used to be a rough rule that the gun must have a diameter equal to the thickness of the plate to be punched; thus a 9 in. gun would punch 9 in. plates, a 12 in. gun 12 in. plates, and so on. But the new 9 in.



IMPROVED FOG HORN *(see page 12).*

gun can punch 16¼ in. of armour at 1000 yards. This is a terrible weapon, and must by no means be taken as representing finality.

We shall make no attempt to follow Mr. Trevelyan through his speech, which all deserves perusal by those interested in the Navy, but proceed at once to deal with the position of engineers in ships of war. Sir E. J. Reed and other speakers all ably advocated their claims to consideration. So far as we understand these claims at present, they are not for augmented pay, but for improved position. Engineers wish for higher rank and more social advantages on board ship. Now we have long and persistently advocated the cause of the engineers in the Navy, and we must not be accused of speaking harshly or unjustly concerning them when we say that they are gradually drifting into a false position, and that much mischief in one shape or another may ultimately be done to their cause by themselves. It is a standing subject of complaint at present, that the modern naval engineer is neither a gentleman nor an engineer; and with limitations, we are compelled to accept the statement as not far removed from the truth. Before going further we must add that there are in the Navy numbers of men who are both engineers and gentlemen in the fullest sense of the words, and these officers will be the first to admit that there are also many men who are neither. The law of the survival of the fittest may come into play, and in process of time the "shovels" will all disappear, and educated gentlemen, quite entitled in every respect to rank with and mess with the other officers, may take their place. Then there will be no more complaints about want of social status. The combatant officers will like the engineers, and will associate with them as their social equals. No possible rule which an Admiralty could frame could bring about this result. What the engineers want they must get for themselves by themselves, and we have no doubt that the new men coming in under the present system and specially educated, will ultimately have nothing to complain of; and that this result is generally anticipated is demonstrated by the apparently growing popularity of the service. "With regard to the engineers," said Mr. Trevelyan, "a great deal has been done. But I think it undesirable that whenever a new Board of Admiralty comes in changes should be looked for. But the Admiralty fully recognizes the change of *status* which is being effected in the case of the engineer. At the same time I think their position is looked upon as a good one, for in 1877 I find that for forty-two posts there were 142 candidates in the engineer's serve; in 1878, 214 candidates for sixty posts. In 1879, forty vacancies attracted 230 candidates; and in 1880 there were 188 candidates for sixty-five posts. As regarded the character of the candidates the right hon. member for South Devon said that they were just the sort of men that were wanted. I do not think, therefore, that at the present time we are justified in raising the pay of the engineers. At the same time we will carefully watch over the interests of that branch of the service, and it is admitted that they deserved somewhat different treatment from what they have hitherto received. There is great difficulty in the question of cabin accommodation, but the recommendations of the committee will be kept in view."

But the whole question can be regarded from another point of view, and much that is now said concerning engineers in the Navy induces us to question whether it is desirable that gentlemen should be employed in the engine rooms of our ships. They may have no cause to complain; but the country may have good reason to wish that gentlemen did not go into the engine rooms. A great deal is said about the responsibility devolving on the engineers of a large ironclad. But just as much and more devolves on the driver of every express train in the kingdom. The value of a fast passenger train with its engine may be taken at a moderate estimate at £10 000, and the whole of this may be lost by a single act of negligence on the part of an engine driver. He has besides many lives depending for safety on him. It would be almost impossible for a naval engineer to do £10,000 worth, or even £1000 worth of damage by negligence—except systematic and protracted negligence —on board an ironclad. The naval engineer has no designing to do. He can alter nothing; he builds no engines; he is not expected to make a suggestion; his use on board ship is to keep the machinery in order, and to do this he must take off his coat and use his hands. Brain work is scarcely needed at all. But gentlemen do not follow handicraft trades; and the work of a naval engineer if it is properly done is the work of a tradesman, and is not professional labour. The engineers know this perfectly well, and the man who works is called by those who do not a "shovel." The new men wear kid gloves and keep their uniforms clean; and to meet this evil and get work done the Admiralty have had to call into existence an entirely new class within the last ten years, namely, the engine-room artificers, on whom, in some ships, devolves all the dirty work, and, in fact, all the work of every kind requiring the use of tools or an oil can. Now this is not as it should be, and we are disposed to think that the country would be much better served by employing thoroughly competent artisans, men who are not afraid of a chisel and hammer, to look after the machinery of our ironclads, than the class now finding its way into our engine-rooms. Each ship ought, however, to carry a superintending engineer, who would, as a matter of course, be an educated, cultivated gentleman. He would have his foremen under him, and would take charge of all the machinery in the ship. His position would be analagous to that of the engineer of any of the large works and factories with which England abounds. No matter what may be said on the subject by those who know little or nothing about it, the charge of marine engines in the Navy is not ennobling, nor exalted, nor intellectual. It involves nothing which calls for the display of talent, and it gives a really clever man no opening whatever.. In the mercantile marine an able man has a hundredfold the opportunity of doing something which will show that he has brains and can use them. Under the circumstances we regard the present system as a mistake, and in this view we are supported by large numbers of engineers who have given the subject their attention.—*Engineer.*

THE ERICSSON "DESTROYER."

SINCE the introduction of the torpedo as an implement of naval warfare, varied and extended improvements have been made towards its perfection, and no one has probably given as much thought and study to the subject as Captain John Ericsson. He has recently produced a projectile which, it is claimed, eclipses all other inventions in that direction, and which he has appropriately named the *Destroyer.* He claims this to be a culmination of his theory which he discussed with Napoleon in 1854. The torpedo boat is said to be peculiarly a Yankee invention, the first ever known being a very primitive model, invented by Captain David Bushnell, of the Engineer Corps, United States Army, and launched in New York harbour in 1776. The torpedo was to be exploded by a clockwork fuse. In 1777 a schooner was destroyed in the harbour of New London, Connecticut, by a drifting percussion torpedo, which was directed against a frigate and missed its mark. In 1807 Robert Fulton experimented with four different torpedoes of his own invention in this harbour with success. Colonel "Sam" Colt, the celebrated arms manufacturer, applied electricity to the ignition of submarine torpedoes in 1843. During the late war of the Rebellion nine ironclads, eleven wooden vessels, and nine transports were destroyed by American torpedoes. Those used on the Danube by the Russians were spar torpedoes, of the same pattern as that used in blowing up the ram Albermarle, on the Albermarle Sound, by Lieutenant William B. Cushing, United States Navy. The Ericsson moveable torpedo was experimented with during the summer and fall of 1875, under the supervision of the inventor's agent, and a full knowledge of the mechanism was obtained.

For the past five years Captain Ericsson has devoted himself to working out the problem of torpedo explosives, and he has succeeded in developing one of such power and vehemence that the very shock would suffice to entirely destroy any war vessel ever constructed. After considerable experimenting, he conceived the idea of substituting gunpowder for compressed air in the propulsion of submarine torpedoes carrying destructive charges of dynamite. His first trials were prosecuted with a projectile of peculiar form and a gun of novel construction, both devised by himself. The greater portion of these experiments, it should be observed, have been carried out with a gun thirty feet long and fifteen inches calibre—not a breech-loader, as in the *Destroyer*, but a muzzle-loader, suspended under the bottom of two wrecking scows, the gun being lifted above the water after each shot by shears and suitable tackle: Several experiments were conducted on the Hudson River, where the water was so shallow that the torpedo invariably sank into mud out of sight, and he was obliged to continue his experiments at Sandy Hook, where the bottom was so hard that he found no difficulty in recovering the torpedo cylinder. The results of the experiments proving so successful, Captain Ericsson has built, at his own expense, a vessel, which he styles the *Destroyer.* This vessel now lies at the Weehawken coal docks, above Hoboken, where experiments have been carried on for a long time, and were concluded on November 11th, the last shot being then fired. The *Destroyer*, to an ordinary observer, would not in the least reveal its mysterious purpose as a most remarkable engine of naval warfare. It is simply an unarmed iron-clad vessel, with bows and stern wedge-shaped, and when ready for action the hull is nearly submerged. The form of the hull is very peculiar, both ends being precisely alike, terminating with very fine wedges, probably sharper than any vessel of deep draught yet built. The length is one hundred and thirty feet, depth eleven feet, extreme breadth of beam twelve feet, thus presenting the unusual proportion of eleven times greater length than beam. The rudder is wholly unconnected with the visible part of the stern, being attached to a vertical wrought iron post, welded to a prolongation of the keel, just aft of the propellor, its upper part being nearly four feet below the water line. The tillers consist of thin plates of iron, rivetted on opposite sides of the rudder, a few inches from the bottom. These tillers are operated by straight rods connected to the pistons of horizontal hydraulic cylinders of five inches diameter, attached to the sides of the keel. Accordingly, the steering gear will be placed ten feet below the water-line, while the top of the rudder only reaches within five feet of the water-line. The leading feature in the construction of the hull is its being provided with an intermediate curved deck, extending from stem to stern, composed of plate-iron strongly ribbed and perfectly water-tight. This intermediate deck sustains a heavy, solid armour-plate, placed transversely to the line of keel, thirty-two feet from the bow, inclined at an angle of forty-five degrees, and supported on the aft side by a wood backing four feet six inches deep at the base. The steering wheel is applied behind this wood backing, a wire rope extending from its barrel to a four-way cock near the stern, by which water pressure is admitted alternately to the hydraulic cylinders at the stern, the motion of whose pistons actuate the rudder. The lower division of the vessel is supplied with air for supplying the boiler furnaces by powerful blowers drawing in air from above. Owing to the peculiar construction of the vessel there is no reason why she would not live at sea in any weather.

Above the intermediate deck is the deck-house or cabin, seventy feet long, composed of plate-iron, and is rivetted watertight to the upper part of the hull. This will be used as the quarters for both officers and crew. The helmsman stands in a pit in the forward end, where he steers the vessel and discharges the gun by a battery. A small glass port, level with his eyes, gives him a view of the course of his vessel and the position of the enemy. He is protected from the fire of the enemy by a wrought-iron invulnerable armour plate, sixteen inches in thickness. A heavy armour plate also protects the base of the smoke stack, so that the entire superstructure and the exposed part of the smoke stack may be shot away, and still the vessel not be disabled.

The forward and after part of the main-deck of the boat is plated with one inch wrought-iron, and on the forward deck is a deflecting armour plate which runs down to the base of the intermediate deck. The gun from which the torpedo is fired is placed on the bottom of the forward part of the vessel next to the keel, the muzzle terminating in the stem seven feet below the water line. The water is prevented from rushing through the gun into the bilge by an outboard valve opened and closed automatically. The small quantity of water rushing into the gun between its discharge and the closing of the valve is run into the bilge after the breech of the gun is opened, and is then pumped out by a steam syphon.

The gun is a smooth-bored cylinder, breech-loading, 30 ft. in length, 16 in. diameter of bore, made of wrought-iron, and hooped with steel. The breech swings upward and over when opened, and when the torpedo and the gunpowder charge is in, it is swung back and locked upon the clutch principle. The projectile, or torpedo, is 25 ft. 6 in. long, 16 in. diameter, and, including the charge of two hundred and fifty pounds of dynamite or explosive matter, weighs fifteen hundred pounds. The body of the projectile is made of wood, and its shape can be best described by likening it unto an enormous cigar. The point, or dynamite section, is made of copper, and a cast-iron armature is affixed to the tail to balance the weight of the opposite end. The charge of powder is put into the space between the tail of the projectile—after it has been placed in the gun—and the breech of the gun, and then the breech closed. A fuse, connecting with the combustion chamber, is ignited by electricity. The initial velocity with which the torpedo leaves the gun is at the rate of one hundred and sixty miles an hour, or two hundred and fifty feet a second. With a minimum charge of powder in the gun the projectile traversed the first three hundred and ten feet in three seconds.

In all the experiments which have been conducted, common cord nettings have been used to determine whether there was really any trajectory in the travel of the torpedo. At firing distances of 250 and 300 ft. the course of the torpedo through the water was perfectly straight. The tide currents have no effect whatever on the course of the torpedo, nor can its course be detected as it travels through the water, as it does not make the slightest commotion when discharged. The torpedo is fired absolutely by concussion, and is calculated to strike a vessel at any point below the water-line. It has been proven that a vessel like the *Invincible*, even with a hundred water-tight compartments, could be sunk by a single torpedo, and that a mosquito fleet of torpedo boats could destroy the largest navy of ironclads. The *Destroyer* is intended to supersede steam rams; it attacks bows on in defiance of the opponent's fire, being protected by inclined transverse armour plates, and has an average speed of 16 miles an hour. Instead of having a lot of ironclads for harbour defence, forty or fifty *Destroyers* could be built and completely equipped for what one *Invincible* would cost.

The machinery of the vessel is entirely below the water-line, and below the intermediate deck, so that it is impossible for the boat to become disabled from the shots of the enemy. The main condenser of the engines, which is a pair of direct-acting, forms the bed-plate. The entire machinery is so compact that it only occupies a space less than 8 ft. square, and the engines may be worked up to 1,000 indicated horse-power. A single cylindrical tubular boiler, with two furnaces running fore and aft of the vessel, the fire-room connecting with the engine-room, furnishes the engines with steam; and the whole is so economically arranged that it only requires an engineer and fireman on each watch. A patent fan-blower keeps up the circulation of fresh air, and keeps a low temperature in the engine department. The steering gear, operated by hydraulic machinery, runs alongside of the keel, and the top of the rudder is 5 ft. below the water-line.

THE CORROSION OF IRON AND MILD STEEL.

AT the meeting of the Institution of Civil Engineers, held on Tuesday, the 22nd of March, Mr. Abernethy, F.R.S.E., President, in the chair, the paper read was on "The Comparative Endurance of Iron and Mild Steel when exposed to Corrosive Influences," by Mr. D. Phillips, M. Inst. C.E.

The author was a member of the committee appointed by the Admiralty, in June, 1874, to inquire into the causes of corrosion in boilers, and since the dissolution of the committee he had made further experiments with the same objects in view. The results were given of numerous tests, the surfaces of the specimens in nearly all cases being bright. Illustrations were shown of gutta-percha and plaster-of-Paris impressions taken from many of the specimens. Tubes of different brands of iron and steel were subjected to various tests in a special apparatus at Sheerness Dockyard. Some of the tubes were welded, others were cold drawn; with one exception, they were all specially prepared. Each tube had an exposed surface of 9.58 square feet. The iron tubes lost 45.4 per cent. less in weight than the steel. Small discs of iron and steel were also tested in another set of tubes in the same apparatus. The percentage in favour of the irons was 56.7. Pieces of iron and steel, of different brands, were suspended for twelve months in two marine boilers, one vessel having a jet condenser, and the other a surface condenser, and also in a feed-water heater supplied with fresh water. The percentages in favour of the irons were 32.7, 27.5, and 11.8 respectively. Plates of Bolton steel and Lowmoor iron, 10 in. by 8in., were likewise placed in the boilers of the two vessels mentioned. Half of the number were withdrawn after thirteen months, and gave a percentage in favour of the irons of 32.7—corrosion in the steels, in the form of pitting, being most marked. Of the remaining eight plates, four remained in the boilers twenty-one months and four twenty-two months, the result being 28.6 per cent. in favour of the irons. Plates of the same two metals, 15 in. by 8 in., were suspended for thirteen months in the feed-water heater. The percentage in favour of the irons was 10.9. The corrosion in the steels was only slightly more marked and irregular than in the irons. Plates of Lowmoor iron and Landore steel, suspended in pairs in vessels, under slightly different conditions, gave a percentage of 4.8 in favour of the irons.

The author next referred to a series of experiments with iron and steel plates (crucible, Bessemer, and Siemens steels, and Staffordshire and Yorkshire irons), suspended in the boilers of ocean and coast-going steam vessels belonging to various shipowners. The exposed surface of each plate was 37.87 square inches. Taking the results from fifty-six sets the percentage in favour of the two irons over the Bessemer and Siemens steels was 21.3. The different results obtained from some of the sets might be thus summarised: No. 43 set was suspended in the boiler 285 days. The boiler was filled fourteen times with fresh water, 2 in. of water being blown off daily. No. 2 set was in the boiler 311 days. The boiler was filled eight times with fresh water, and five times with sea water, 3 in. of water being blown off daily at sea, and 12 in. at intermediate ports. The mean loss of weight in No. 2 set was 825.4 grains, as compared with 347.7 grains in No. 43 set, or nearly 2½ times as much. Boiler 62 was filled five times with fresh water, 1 in. of water being blown off daily. The plates were in the boiler for 298 days. The mean loss of water was 364.9 grains, as compared with 825.4 grains in No. 2 set. Set 8½ was in the boiler 43 days, the boiler being filled four times with sea water and once with fresh water, an average of 73 in. of water being blown off daily. The mean loss of weight was 575.7 grains as against 364.9 grains in 62 set, being at the rate, per month of thirty days, of 401.78 grains in 84 set, against 36.7 grains in 62 set. Comparing set No. 9, which was suspended in a jet-condensing boiler, with 62, which was subjected to something like the most improved method of surface-condensing treatment, the loss in No. 9 was nearly four times that in No. 62 set. These results clearly proved the error of the conclusions arrived at by many experienced persons previous to the appointment of the boiler committee.

Experiments made by the author with plates similar to those last mentioned, placed in sea water, in rain water, exposed to the weather only, and exposed to the weather and dipped in sea or rain water daily, gave a result of 64·8 per cent. in favour of the irons, omitting the hard steel. The corrosion was strikingly local and severe in the set placed in rain water. Wetting the metals daily, especially with sea water, and exposing them to the weather, caused very severe corrosion. The results of these experiments incontestably proved, that under almost all circumstances iron, and especially the harder sorts, was far superior to steel in the resistance it offered to corrosion.

The author remarked that, in his opinion, such theories as that corrosion, was caused by galvanic action between metals and their oxides, or between different brands of iron or steel, or between iron and steel, were practically unworthy of consideration. He then proceeded to say that steel had probably received more than its fair share of praise as regarded homogeneity and uniformity of temper. Although iron was inferior to steel as regarded cinders, laminations, &c., yet mild steel was not without original defects, as was shown by several of the gutta-percha impressions. Moreover some of the tubes and discs before mentioned presented after testing a damaskeen appearance similar to gun barrels.

Surprising differences of temper were exhibited in the cold bending of the metals tested in the tube apparatus, not only between the various brands, but also between the tubes of each brand. The difference between the behaviour of the tempered and the annealed steel specimens under the cold bending test was also most marked.

It would seem that in the purifying of metals, in order to render them more ductile, elements, such as carbon, phosphorus, &c., were eliminated, which no doubt rendered the metals more liable to corrosion. In the metals tested in sea-going boilers the ordinary BB Staffordshire iron proved 9.6 per cent. better than the best Yorkshire, as regarded loss of weight, and the harder steel 20.9 per cent. better than the two mild steels. In the tube experiments the ordinary iron tubes proved 122.2 per cent. better than those specially prepared. Again, the tubes called "improved metal" were 31.1 per cent. better than the tubes called "improved homogeneous metal," by far the most ductile and expensive of the two.

It appeared from recent analyses that the percentage of phosphorus ranged from 0.20 to 0.21 in the cruder irons, from 0.7 to 0.14 in the better sorts, and from 0.016 to 0.04 in the milder steels. The amount of carbon in iron ranged from 0.0545 to 0.074 per cent., whilst in mild steel it varied from 0.131 to 0.273 per cent. From 0.0649 to 0.1080 per cent. of manganese was found in iron, and from 0.238 to 0.3317 per cent. in steel. These results confirmed the authors' conclusions, that the commoner irons, containing the most phosphorus, resisted corrosion better than the superior sorts, and the harder steels, containing the most carbon, better than the softer and finer sorts.

In conclusion, the author remarked that much yet remained to be done to produce a metal at once strong and ductile, but at the same time better able than mild steel to withstand corrosion. On the other hand, the treatment of marine boilers might be so modified, especially with the aid of zinc properly applied, as to enable the purer metals to be used in their construction.

THE new firm of shipbuilders established at Scotswood has, it is stated, secured a contract to build a large vessel for French owners. Shipbuilding at Scotswood In the upper reaches of the Tyne, is something to note. Hitherto only small boats—until the dredging of the Tyne Commissioners deepened the river—could be navigated to that locality. Little or no change had been made for centuries —probably ever since the Romans sojourned on the Tyne in that part of the ancient river. Fifty or sixty years ago an effort was made to get a company, with adequate capital, to cut a canal across to the Mersey to join, for purposes of navigation, the east with the side of the land, but the project fell through. That was long before the North-Eastern Railway was formed to Carlisle from Newcastle.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Gironde.—On February the 26th Messrs, C. S. Swan & Hunter, Wallsend, launched an iron screw steamer, built for the Cardiff Steamship Company, and intended to run between Cardiff and France. The vessel was named the *Gironde* by Mrs. Hooper, of Sunderland, and will proceed to the Wear to have her machinery fitted by Mr. George Clark.

Fedele Primavesi.—On February 28th there was launched from the Jarrow-yard of the Palmers S. & Iron Company (Limited), a screw steamer bearing the above name, and of about 2,300 tons carrying capacity. This steamer has been built under special survey and to the highest requirements of Lloyd's 100 A 1 class. She will be fitted with every modern appliance for rapid discharge and reloading, as also for economy in every detail of working. She carries Emerson Walker & Co.'s Patent Brass Cone Brake Combination Windlass. She will be employed in the general carrying trade. This steamer is the third built by the Palmers Company to the order of Messrs. J. and R. Bovey, of London and Cardiff, and the christening ceremony was performed by Mrs. Robert Bovey, the wife of one of the Managing Owners. A special feature in the steamers managed by the above firm is that each steamer is registered under the Companies' Acts as the property of a limited company, thus securing to the shareholders immunity from liability beyond the amount of each share. This third steamer will be registered as the property of the Fedele Steamship Company (Limited). Messrs. J. and R. Bovey have also contracted with the same builders for a fourth steamer, of 2,700 tons deadweight capacity, and suitable for Atlantic, Mediterranean, or Indian trades.

Bothwell Castle.—On March 1st, Messrs. Raylton, Dixon & Co. launched from the Cleveland Dockyard, Middlesborough, a steamer built to the order of Messrs. Thomas Skinner & Co., of London and Glasgow, and will form one of their well-known "Castle" Line to China, for which Messrs. Dixon are also laying down for them another rather larger vessel. The *Bothwell Castle*, as the present vessel has been named, has a beautiful clipper bow, and full figurehead of Mary, Queen of Scots. She will carry nearly 4,000 tons of tea, and her dimensions are 345 ft. extreme length, 38 ft. 6 in. beam, 27 ft. 6 in. depth moulded, and about 2,600 tons gross register. Her decks, rails, and fittings are entirely of East India teak, and her passengers will be accommodated in a deckhouse aft wheel. She is fitted with Harfield's patent steam windlass and Bow & M'Lachlan's steam steering gear. The engines, of 280 horse-power nominal, are being constructed by Messrs. Thos. Richardson & Sons, of Hartlepool, where she will be taken next week to have them fitted on board.

Roseville.—On March 1st Messrs. W. Gray & Co. launched from their shipyard at West Hartlepool an iron-screw steamer, built to the order of R. Shadforth & Co., of Sunderland, which is the third steamer built by Messrs. Gray for them. Her dimensions are:—Length, 257 ft. 6 in.; breadth, 35 ft. 6 in.; depth of holds, 19 ft. and 23 ft. 6 in.; classed 100 A1 at Lloyd's, and built under the survey of Captain Thomas Watson, Hartlepool. The engines are 150-horse power by Messrs. Blair & Co., Stockton, and carries Emerson, Walker & Co.'s Patent Combination Windlass. She is built with double bottom on the new longitudinal and bracket system, and is specially fitted to carry grain under the new Act by having a permanent iron bulkhead full depth of hold all fore and aft. As she left the ways she was christened the *Roseville* by Miss Shadforth, of Fernville-house, Sunderland.

Mariner.—On March the 1st Messrs. M. Pearce & Co. launched from their iron shipbuilding-yard at Stockton-on-Tees, an iron screw steamer of the following dimensions, viz.:—Length over all, 257 ft., breadth extreme, 32 ft.; depth of hold from top of floors, 21 ft. 2 in.; gross register tonnage, about 1,420 tons. The steamer has been built to the highest class (100 A) at Lloyd's, under special survey. Has full poop, bridge, topgallant forecastle, and is fitted with three steam winches, patent windlass, &c. Engines are of 120-horse power, by Messrs. Blair & Co. As the vessel took the water she received the name of *Mariner*, and has been built to the order of a Liverpool firm.

Lockyer.—On March the 2nd Messrs. Bertram, Haswell & Co. launched from their iron shipbuilding-yard, South Dock, Sunderland, an iron screw steamer for Messrs. Wilkie and Turnbull, of North Shields. The principal dimensions are:—Length over all, 300 ft.; breadth, 37 ft.; depth, 24 ft. 6 in.; deadweight capacity, 3,100 tons. The vessel has been built under special survey to pass the highest class 100 A1 in London Lloyd's, and 20 years in Liverpool registry. She is specially designed for the American and Indian trades; the main deck is of iron, and the upper deck of iron covered with wood. She is built on the cellular tank system; has iron longitudinal bulkheads from keelson to main deck, in accordance with the provisions of the Board of Trade, in order to reduce the danger of cargo shifting (such as grain, &c.) to a minimum; has water ballast fore and aft, and is of immense strength. She is fitted with steam steering gear, and four large steam winches by Clarke, Chapman & Gurney, with Clarke's patent donkey boiler, also Emmerson, Walker & Co.'s Patent Windlass. She will be fitted with a pair of Mr. John Dickinson's compound surface condensing engines of 200-horse power, and provided with all the latest improvements in marine engineering. The vessel has a short full poop, topgallant forecastle for the accommodation of seamen and firemen, long bridge amidships extending over engine and boiler room. The ceremony of christening was performed by Mrs. Chas. Turnbull, wife of one of the managing owners, who named the vessel the *Lockyer*.

Plessy.—On March 2nd a steamer, named the *Plessy*, was launched from the ship building-yard of Messrs. Hodgson & Soulsby Cowpen Quay, Blyth. The *Plessy*, which is intended for the Indian and Atlantic trades, has been built to the order of Messrs. Watts, Ward & Co., of London, Newcastle, and Blyth, and is of the following dimensions:—Length over all, 264 ft.; extreme breadth, 36 ft.; depth of hold, 23 ft. She is built on the three-deck principle, and classed 100 A 1 at Lloyd's. The estimated dead-weight capacity of the vessel is about 2,450 tons, and she will carry about 10,000 quarters of heavy grain, besides 200 tons of fuel. The steamer will be fitted with compound surface-condensing engines of 160-horse power, with extra-sized boilers and shafting, the machinery to be made by Messrs Blair & Co., Stockton, and will be classed at Lloyd's M.C.

Embleton.—On March 2nd Messrs. W. Gray & Co. launched, from their yard at West Hartlepool, an iron screw-steamer, built to the order of Messrs. G. T. Pearson & Co., West Hartlepool, and is the second built for the same firm within three months. Her dimensions are:—Length, 256 ft. 6 in.; breadth, 34 ft. 6 in.; and depth of holds, 19 ft. 8 in., and 24 ft.; class 100 A 1 at Lloyd's, and built under the survey of Mr. Cornforth, of Hartlepool; engines, 150-horse power, by Blair & Co, Stockton; will carry a dead-weight of 2,350 tons. As she left the ways the new vessel was christened the *Embleton* (after a village near Wynyard), by Miss Pearson, of Castle Eden, daughter of the Managing Owner.

Saxon Prince.—On March 3rd an iron steam vessel, the *Saxon Prince*, was launched from the shipyard of Messrs. Swan & Hunter, at Wallsend. The ceremony of christening was performed by Mrs. N. B. Main, of Gateshead. The *Saxon Prince*, which is built to the order of Mr. James Knott, of Newcastle, is intended principally for the Bilbao trade, and is of the following dimensions, &c.:—Length, 215 ft.; breadth, 30·8 ft.; depth (moulded), 16·10 ft.; dead-weight capacity, 1,250 tons, on about 14 ft. 6 in. water; long raised quarter-deck, topgallant forecastle, with accommodation for crew, double bottom throughout for ballast, iron decks; engines, 100-horse power, supplied by Messrs. Black, Hawthorne & Co., and will be ready in April.

Fairfield.—On March 5th there was launched, from the Jarrow shipbuilding yard of the Palmers Shipbuilding & Iron Company (Limited), the screw steamer, *Fairfield*, built for Captain Joseph Brown and Partners, Liverpool. The *Fairfield* measures 260 ft. in length over all; 34 ft. beam, and 20½ ft. depth of hold, and is constructed to carry 2,200 tons deadweight; she is classed 100 A 1 at Lloyd's, and will be fitted with a pair of Palmer's compound surface condensing engines, of 30 in. and 60 in. cylinders, and 36 in. stroke.

Agnes Otto.—On March 15th a screw steamer, of the following dimensions, was launched from the iron shipbuilding yard of Messrs. John Readhead & Co., South Shields, namely:—Length, 260 ft.; breadth, 32 ft.; depth of hold, 18 ft.; and deadweight capacity, 1,900 tons. The vessel will be fitted by Messrs. Readhead & Co. with compound surface condensing engines of 130 nominal-horse power. She has been built to the order of Mr. George Otto, of North Shields, and upon leaving the ways she was named the *Agnes Otto*, by Miss Jenny Otto, daughter of the Owner. The new steamer will be employed in general trades, and will be commanded by Captain John Oliver, of South Shields.

Thorn Holme.—On March 17th Messrs. J. L. Thompson & Sons launched from their shipbuilding yard, North Sands, an iron screw steamer of the following dimensions, viz.:—Length, 260ft.; breadth, 36 ft,; depth of hold, 18 ft, 6 in.; and of 2,200 tons burthen, built under special survey to class 100 A 1 at Lloyd's, The engines, which are on the compound surface condensing principle, of 160-horse power, are being supplied by Mr. George Clark, of Southwick Engine Works. This vessel has been built to the order of Messrs. Hine Brothers, of Maryport. She will be fitted with four horizontal steam winches, Harfield's patent windlass, and patent steam steering gear by Donkin & Nichol, of Newcastle, and other modern improvements, The naming of the vessel, *Thorn Holme* was performed by Madame Lachere, of Antwerp.

Southbourne.—On March 18th the *Southbourne* (s) was launched from Messrs. Blumer's yard, North Dock, Sunderland. The vessel is the property and built to the order of Mr. D. P. Garbutt, of Hull. Her dimensions are:—Length between perpendiculars, 275 ft.; extreme breadth, 36 ft.; depth of hold, 24 ft.; gross tonnage, about 2,100 tons register; deadweight capacity, 2,800 tons. The *Southbourne* will be fitted with engines by the North-Eastern Marine Engineering Company, of 180-horse power. All the latest improvements have been introduced into the vessel to render her suitable for the Atlantic and Indian trades.

Abeona.—On March 19th a screw steamer, named the *Abeona*, built for Messrs. Graham, Anderson & Co., of Carlisle, Tyne Docks and Maryport, was launched from the iron shipbuilding-yard of Messrs. Bartram, Haswell & Co., South Dock, Sunderland. Her principal dimensions are:—Length between perpendiculars, 200 ft.; breadth, 30 ft.; and depth of hold, 15 ft. 6 in. She has been built under the inspection of the Liverpool Underwriters' Surveyors, also the Owners' Surveyor, and will obtain the highest class in the Underwriters' Registry. The general arrangements of the vessel are:—Topgallant forecastle, large bridge which covers and protects the engine and boiler rooms, and also covers the Officers' and Engineers' cabins; steam windlass of Emerson & Walker's patent; three powerful steam winches, by Clarke, Chapman, & Gurney; strong steering gear, and every convenience, including large hatchway, for the speedy and efficient working of the vessel. The cabins are aft under a half-poop. The engines have been constructed by Mr. John Dickinson, of Sunderland, and are of 120-horse power nominal, with cylinders 27 in. and 51 in. in diameter, with a stroke to each of 36 in.; boilers capable of bearing an ordinary working pressure of 80 lbs. per square inch. The ceremony of christening was performed by Mrs. Graham, wife of one of the Managing Owners, who named the steamer, *Abeona*. She will be under the command of Captain Temple.

Copley.—On March 19th Messrs. Ismay, Imrie & Co., of the White Star Line, received a further addition to their fleet of sailing vessels, making the second this year launched on the Mersey. The new vessel, which is named the *Copley*, is a ship of the following dimensions:—Length, 263 ft.; breadth, 39 ft. 1 in.; depth, 24 ft. 1 in.; and registering 1,750 tons nett, which has been built to their order by Messrs. W. H. Potter & Son, and was launched from the building yard of that firm at the Queen's Dock. The ceremony of naming the vessel was performed by Miss Anita Guthrie Williamson, daughter of Stephen Williamson, Esq., M.P. for the St. Andrew's Burghs, from whose estate in Cheshire the *Copley* takes her name.

Refulgent.—On March 21st Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw steamer for local owners, making the ninth vessel built by them for the same firm. She is of the following dimensions:—Length, 216 ft.; breadth, 30 ft.; and depth of hold, 16 ft. 4 in.; with a deadweight carrying capacity of 1,400 tons. She is constructed on the cellular bottom principle, has a long raised quarter-deck, bridge-house over engines, and boiler amidships, and topgallant forecastle. She is constructed to the highest class in the Liverpool Registry, under special survey. The hatchways, four in number, are very large, for the purpose of self-trimming, and she has all the latest improvements for quick loading and discharging. On leaving the ways the vessel was named the *Refulgent*, the ceremony of christening being performed by Miss Mail, of Sunderland. After the launch the vessel was taken in tow for the South Dock, where she will be fitted with engines and boilers of 100-horse power by Mr. John Dickinson, Monkwearmouth.

Iron Acton.—On March 22nd there was launched, from the dockyard of Messrs. Raylton, Dixon & Co., of Middlesbrough, a steamer named the *Iron Acton*, built to the order of Bristol Owners for the timber trade. Her dimensions are:—Length over all, 235 ft.; breadth, 32 ft. 6 in.; depth of hold, 16 ft.; and she will carry about 1,450 tons on light draught. She has water ballast in after and main holds, and iron decks right fore and aft and will be fitted with engines of 100-horse power, by Messrs. Thomas Richardson & Sons, of Hartlepool.

Dawn.—On March 27th there was launched from the yard of Messrs. Edwards & Symes, at Cubitt Town, a screw steamer of the following dimensions:—Length, 100 ft.; breadth, 15 ft.; depth, 9 ft. This vessel is intended for the inter-island trade in the West Indies, and is the pioneer vessel of a company of colonial merchants, who have entrusted their commands to the firm of Messrs. Pile & Co.. As the vessel left the ways she was christened the *Dawn* by Mrs. C. H. Pile.

St. Donato.—A screw steamer named the *St. Donato*, of 2,200 tons, was launched a few days ago from the building yard of Messrs. Schlenger, Davis & Co., at Wallsend. She has been built to the order of the St. Donato Steamship Company, of Cardiff, the Managing Owners being Messrs. Harrison Brothers & Moore, also of Cardiff. The length of the *Donato* is 260 ft., breadth 35 ft., and depth of hold, 20 ft. 4½ in.

Brunswick (s.s.).—On March 2nd, Messrs. Wm. Pickersgill, of Sunderland, launched from their yard the s.s. *Brunswick*, built to the order of Mr. John Bacon, of Liverpool. She is a sister ship, so far as the model is concerned, to the s.s. *Stuart*, recently built by the same people for Mr. Bacon, but the general arrangement plan, which is the design of Mr. Joseph R. Oldham, under whose superintendence the ships and machinery have been constructed, is quite new. The vessel is 245 ft. by 33 ft. by 18 ft., and she will carry 1,910 tons dead weight. The saloon is amidships, with captain's room, spare state room, steward's berths, bath room, pantry, &c., all at fore-end of bridge, and the engineers' rooms and mess room are at the after end of bridge. There is an extra large wheel-house aft, and the chart room, companion and midship wheel-house are all in one. Two of the hatches are extra large, being suitable for taking in locomotives or large pieces of machinery. There is water ballast in both holds and in after peak. She is fitted with a very powerful steam crane and three large steam winches, Harfield's patent windlass, &c. The engines are by Mr. George Clark, of Sunderland, and are 130 nominal horse-power. The vessel takes the highest class in Lloyd's, and is considerably in excess of their requirements.

Embleton.—On March 17th a finely-modelled iron sailing barque—built to the order of Messrs. Peter Iredale & Son, Liverpool—was successfully launched from the shipbuilding yard of Messrs. Robert Thompson & Sons, Southwick, Sunderland, of the following dimensions, viz.:—226 ft. long by 36 ft. broad, and 21½ ft. depth of hold; having been built under Lloyd's special survey to class 100 A1. She has a raised quarter-deck and monkey forecastle, large iron deck-house amidships, with accommodation for crew and apprentices; cabin aft, fitted up for captain and officers, and with spare berths; and is fitted throughout with all the latest improvements for a vessel intended for the Indian and China trade. As she left the ways she was gracefully christened the *Embleton* by Mrs. Paynter, wife of the captain of the vessel.

LAUNCHES.—SCOTCH.

Carron Park.—On February 21st a screw steamer, named the *Carron Park*, was launched from the yard of the Campbeltown Shipbuilding Company. The *Carron Park* is a vessel of 550 tons register, 155 ft. keel, 12 ft. hold, and 23 ft. beam. She is built to the order of the Carron Steamship Company (Limited), Glasgow, being the maiden vessel of the firm, and she will be commanded by Captain R. Barclay. She is intended for the fruit and general cargo trade between Liverpool, Nantes, and the Rhone. She will be engined by Kincaid, Donald, & Co., Greenock. Miss M'Nair, Braefoot, named the vessel as she left the ways.

Quetta.—On March 1st Messrs. Wm. Denny & Brothers launched from their shipyard at Dumbarton an iron screw steamship of the following builders' dimensions:—380 ft. by 40 ft. by 30 ft. 6 in., and of about 3,400 tons, for the London and Calcutta line of the British India Navigation Company. She has been fitted with a pair of compound surface condensing direct-acting inverted cylinder engines of 500-horse power nominal, by Messrs. Denny & Co., Dumbarton. She is fitted for a large number of first and second-class passengers. As the steamer left the ways she was named the *Quetta* by Mrs. Macmichael, wife of Neil Macmichael, Esq., of Locksley, Helensburgh, and partner in the firm of Messrs. Wm. Mackinnon & Co., of Glasgow, and Messrs. Mackinnon, M'Kenzie, & Co., of Calcutta, agents in Calcutta for the British India Steam Navigation Company.

Algoa Bay.—On March 2nd Messrs. Russell & Co., shipbuilders. Greenock, launched from their shipbuilding-yard an iron barque of about 1,150 tons, which has been built to the order of Messrs. Hatfield & Co., Glasgow. The vessel's dimensions are as follows:—Length, 220 ft.; breadth, 35 ft; and depth, 21 ft. As she left the ways the barque was named the *Algoa Bay*.

Notting Hill.—On March 3rd there was launched at Messrs. Dobie & Co.'s yard, Govan, the first of three steamers which form an entirely new departure in our commercial Navy. The owners and designers of the *Notting Hill*, and her sister steamers, the *Tower Hill* and the *Ludgate Hill*, now in course of construction by the same builders, have adopted the twin-screw system now invariably applied to the armed Navies of the world, as they believe the modern Transatlantic steamer has reached the dimensions which require the application of means that have, after long trial, been found to ensure speed, handiness, and safety. The two screws at the stern of the *Notting Hill* will propel her 12 knots when laden, and will enable her to turn round almost in her own length, and allow her to entirely dispense with her rudder if anything should disable it. Should an accident befall one set of engines, or shafting, or propellers, the remaining set will propel the vessel at a speed of 10 knots, the average of ocean-going steamers. The *Notting Hill* is built entirely of steel, and it is claimed for her that she will deliver a larger cargoe on her draught than any steamer now running or building. Her 'tween decks, ready fitted with side lights, would carry upwards of 1,000 steerage passengers, or a whole regiment of soldiers, upon the one deck. She has been specially surveyed by the Admiralty, and her eminent fitness will enable her to take a prominent place in the transport service. She is provided, under Admiralty direction, with coal armour for the protection of her engines and boilers, and with such a number of bulkheads, all extending to the upper deck, that the steamer, when loaded, will float even if any one compartment is absolutely open to the sea. Her crank shafts are the latest improved built description, and of Vickers' steel. Her propellers are of the same material, and with movable blades. She is fitted with instantaneous hydraulic starting gear, that enables the movements of both propellers to be controlled at the same time by a mere child. She has Harrison's steam steering gear. Her boilers, 10 in number, with 20 furnaces, are of steel, made upon Turner's patent principle. She has four masts, and turtle backs forward and aft. In the latter ample space for the firemen and crew is provided, while in the saloon and state rooms, all on deck, accommodation has been furnished for cabin passengers in the best part of the steamer, well forward of the engines and boilers. She can carry upwards of 900 head of cattle, for which ample ventilation and movable fittings of the strongest and most improved designs have been provided, She has been constructed under special survey for the highest class at Lloyd's, both hull and machinery. Messrs. James Howden & Co. supplied the engines and boilers. As the *Notting Hill* left the ways the naming ceremony was performed by Mrs. W. H. Nott, of Sefton Park, Liverpool, the wife of the principal owner.

Ranee.—On March 3rd there was launched from Messrs. Ramage & Ferguson's shipbuilding yard, Leith, an iron screw steamer of about 700 tons, for the Borneo Company (Limited), of Singapore and London. The vessel's design is on the new shade-deck principle, and besides having a cargo capacity for about 10,500 piculs of rice, there will be considerable accommodation for both European and native passengers in the poop and deck-houses under the shade deck. Steam winches, steam windlass, and steam cooking apparatus, and many other appliances to suit the vessel for her special trade, which will be between Singapore, Sarawak, and Bangkok, have been introduced, and the arrangements for comfort in a hot climate have been carefully attended to. The dimensions of the hull are 185 by 27 by 21, and the engines, which are of the latest and most improved description, will be of 105 horse-power nominal. As the vessel left the ways, she was named the *Ranee* by Miss Russell, of Dunfermline.

Albingia.—On March 7th Messrs. Dobie & Co. launched from the Govan shipbuilding yard an iron screw steamer, built by them to the order of the Hamburg American Company, to the highest class, and measuring 1,900 tons. As she left the ways, she was named the *Albingia* by Miss Adelaide Isbister M'Ewan, of Barns Terrace, Ayr.

Bretton Hall.—On March 19th Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun, an iron screw steamer of 2,500 tons. She is classed 100 A 1 at Lloyd's, and has been built to the order of Messrs. Alexander & Radcliffe, Liverpool, for their Hall Line, and is fitted up with every facility for the rapid loading and discharging of cargo. As she left the ways she was named *Bretton Hall*, and was immediately towed to the harbour to get her machinery fitted on board, which is being supplied by Messrs. John & James Thomson, Finnieston Engine Works.

Goval.—On March 19th there was launched from the building-yard of Messrs. Hall, Russell & Co., Aberdeen, an iron screw steamer named the *Goval*, of the following dimensions, viz.;—Length, 165 ft. by 23 ft. 6 in. by 12 ft. 6 in., and 450 tons gross register. This vessel has been built under special survey to class 100 A at Lloyd's, and will be fitted with compound surface-condensing engines 65-horse power nominal steam winches, water ballast, and all the most approved appliances for facilitating the loading and discharging of cargoes. The *Goval* has been built to the order of Messrs. Wm. Leslie & Co., and is specially fitted for the Continental herring and grain trade. Shifting boards and portable decks have been provided and arranged to prevent the crushing and shifting of cargoes. Mrs. John Leslie, of Donbank, performed the ceremony of naming the vessel, which was afterwards taken to the sheer poles for the purpose of receiving masts and machinery.

Lorna Doone.—On March 17th Messrs. Blackwood & Gordon launched a gunboat named *Lorna Doone* for Rajah Brooke, of Sarawak. The dimensions are:—Length, 100 ft.; breadth, 17 ft.; depth of hold, 8 ft.; and 150 tons. The builders have fitted the *Lorna Doone* with engines of 40-horse power. She is intended as an auxiliary gun and despatch boat. There are two 9-pounders on board.

Heron.—On March 19th Messrs. Scott & Co. launched from their building-yard at Bowling an iron screw steamer of 150 tons, built to the order of Messrs. R. Walker & Co., Clyde-terrace, Glasgow, and intended for the Loch Fyne herring trade. She will be fitted with compound surface-condensing engines of 45-horse power, by Messrs. R. Harvey & Co., Glasgow. As the vessel moved into the water she was named the *Heron* by Mrs. Gibb, Glasgow.

Palma.—On March the 22nd Messrs. H. M'Intyre & Co. launched from their shipbuilding-yard at Merksworth the *Palma*, an iron screw steamer of 1,100 tons, The *Palma*, which is the property of the Company La Islena, is intended for mail and passenger service between Palma, Barcelona, and Marseilles. She is built to the highest class at Lloyd's, and her passenger accommodation and cargo appliances are of the best description. The poop is fitted with saloon and sleeping accommodation for forty first-class passengers, and also two ladies' cabins, besides pantry, &c. There is accommodation forward for from 80 to 100 second-class passengers, besides two ladies second class cabins, the Officers and Engineers' rooms being placed amidships on main deck. The engines, which are compound surface-condensing and of great power, are being supplied by Messrs. Hutton & Corbett, Glasgow, and are expected to drive the vessel at a very high rate of speed. The ceremony of naming the vessel was performed by Miss Bews.

Bann Whatt Soon.—On March 22nd Messrs. Blackwood & Gordon, Port Glasgow, launched the *Bann Whatt Soon*, an iron screw steamer of about 500 tons, built for trading in the East. She will be fitted with compound engines of 80-horse power nominal by the builders.

Servia.—The Cunard Royal Mail steamship *Servia*, was launched on March 1st, from the shipbuilding yard of Messrs. James & George Thomson, Clydebank, near Glasgow, in presence of a large number of spectators. Great interest was taken in the event from the circumstance that the new vessel is fully 3,000 tons larger than such huge ships as the *Gallia*, the *Arizona*, the *Orient*, the *Furnessia*, and the *Parisian*, being in point of dimensions and tonnage exceeded only by Mr. Scott Russell's famous ship, the *Great Eastern*. The ceremony of naming the ship was gracefully performed by Mrs. John Burns. Among the company present were Mr. John Burns, chairman of the Cunard Company, the Earl of Ravensworth, Lord Balfour of Burleigh, Mr. Baring, Mr. Jardine, Mr. Cleland Burns, Mr. Cunard, Mr. Wilfrid Bevan, Mr. Williamson, Mr. Dudley Ryder, Mr. George A. Burns, the Lord Lieutenant of Dumbartonshire, Captain Townsend, R.N., and officers of Her Majesty's ship *Hercules*, Mr. and Lady Isabella Gordon, and Colonel and Lady Georgina Drummond Murray. The dimensions of the *Servia* are:—Length, 530 ft., breadth 52 ft., depth 44 ft. 9 in.; gross tonnage 8,500 tons. A better idea of the huge size of the vessel will be gained from the following facts. Her cargo capacity will be equal to 6,500 tons, with 1,800 tons of coal and 1,000 tons of water ballast, the vessel having a double bottom on the longitudinal bracket system. The anchor davits are 8 in., and the chain cable pipe 22 in. in diameter. The propeller shaft weighs 26¼ tons, and the propeller, boss, and blades, which are made of Vickers steel, are 38 tons in weight. The machinery consists of three cylinder, compound surface-condensing engines, one cylinder being 72 in. and two 100 in. in diameter, with a stroke piston of 6 ft. 6 in. It is anticipated that the indicated horse-power will amount to 10,500. There are in all seven boilers, six of which are double and one single-ended, and all are made of steel, with corrugated furnaces, the total number of furnaces being 39. Practically the *Servia* is a five-decker, as she is built with four decks and a promenade. The promenade, which is reserved for the passengers, is very large and spacious. On the fore part of it are the steam steering gear and house, captain's room, and flying bridge. On the upper deck forward is the forecastle, with accommodation for the crew, and lavatories and bath rooms for steerage passengers, while aft are the light towers for signalling the Admiralty lights, with the look-out bridge on the top. Near to the midship house are the captain's and officers' sleeping cabins. Next to the engine skylight is the smoking-room, which can be entered from the deck or from the cabins below. It is unusually large for a smoking-room, being 30 ft. long by 22 ft. wide. Near the after-deck house is the ladies' drawing-room, to which access can be obtained either from the music-room or from the deck. Abaft of this, and in the upper end of the upper deck, is the music-room, which is 50 ft. by 22 ft. in dimensions, and which is to be fitted up in a handsome manner with polished wood panellings. Immediately abaft of the music-room is the grand staircase, which leads to the main saloon and the cabins below on the main and lower decks. For the convenience of the passengers there are no fewer than four different entrances from the upper deck of the ship to the cabins. At the foot of the stair leading to the saloon and also in the cabins the panellings are of polished Hungarian ash and maple wood. The saloon is very large, being 74 ft. long by 49 ft. wide, with sitting accommodation for 350 persons, while the clear height under the beams is 8 ft. 6 in. The sides are all in fancy woods, with beautifully polished inlaid panels. All the upholstery of the saloon is of morocco leather. Right forward of the after deck are the pantries, baths, lavatories, and state rooms. The total number of state rooms is 168, and the vessel has accommodation for 450 first class and 600 steerage passengers, besides a crew of 200 officers and men. For two-thirds of its entire length the lower deck is fitted up with first class state rooms. The ship is divided into nine water-tight bulkheads, and she is built according to the Admiralty requirements for war purposes. A special feature is the arrangement of the water-tight doors in the engine and boiler spaces. According to the usual method, the door requires to be screwed down, and this process takes up a considerable time. In the *Servia* they can be shut from the upper deck in case of accident in a couple of seconds by simply using a connecting-rod. There are in all 12 boats, and these are equipped as lifeboats, and have Hill & Clark's patent improved boat-lowering apparatus. The keel of the ship consists of five thicknesses, making a total thickness of 6¾ in.; and in order to secure thoroughly reliable workmanship, the riveting was done by Tweddell's hydraulic riveter. All the frames and beams of the ship were riveted by this process. The upper deck is of steel, covered with yellow pine; the main deck is of steel, with a teak covering; and the lower deck is of steel, with a covering of teak above the engine and boiler spaces. All the deck-houses and deck fittings, which are liable to be carried away in a heavy sea, are made of iron and steel, and are riveted to the steel decks underneath. The *Servia* possesses a peculiarity which will add to her safety—namely, a double bottom or iron skin. Thus, were she to ground on rocks, she would remain perfectly safe while the inner skin continued intact. There are three masts on the vessel, and the Cunard Company have adhered to their special rig, believing it to be more ship-shape than the practice of fitting up masts according to the length of the ship. On these masts there will be a good spread of canvas to assist in propelling the vessel. At the luncheon which followed the launch, Mr. James R. Thomson proposed the toast of "Success to the *Servia*," coupling with it the name of Mr. John Burns, the chairman of the Cunard Company. Mr. John Burns expressed his thanks for the honour done to him in coupling his name with that of the great ship which had been launched, and, in acknowledging the toast, said the difference between their first Atlantic steamer, the *Britannia*, and the *Servia* was marvellous. The *Britannia* started on her first voyage more than 40 years ago. She measured 1,139 tons, had a capacity for 225 tons of cargo, and steamed 8¼ knots an hour. The *Servia* measured 8,500 tons, would carry upwards of 3,000 tons of cargo, with 2,000 tons of coal, as well as 1,000 passengers, and would maintain a speed, he hoped, of not less than 17½ knots an hour. These figures, he remarked, showed at a glance the vast changes which had taken place in steam navigation, and from what he saw in the development of new materials and scientific inventions, he believed that we were upon the threshold of still greater achievements. In the *Servia*, he said, a notable instance was shown of how, as iron superseded wood, steel is superseding iron, and he well remembered the careful calculations into which he went with Mr. James Thomson, the designer as well as the constructor of the *Servia*, in regard to the advantages of steel, and also the crucial testing by scientific experiment of the article itself before he recommended its adoption to his partners. In addition to being stronger and more ductile than iron, it was of less weight, as would be seen when he mentioned that the *Servia*, if built of iron, would have weighed 620 tons more than she did, and would have entailed the drawback of a corresponding increase in draught of water. In regard to scientific discoveries and inventions, he thought that science was, if anything, tending to tread too hastily upon the heels of commerce, there being no portion of a ship, from stem to stern, from truck to keel, which was not subject to suggestive improvement by scientific men; and he could assure them that it required all the proverbial blandness of a chairman to decline the overtures of hosts of suitors who came to ask him to adopt their varied wares. Still, without doubt, there were looming in the future some scientific discoveries which he believed would come to play a most important part in navigation; and he thought we might assume as more than probable that electricity would yet form a powerful factor in the economy of mechanical locomotion. In the meantime the duty of those who conducted great maritime enterprises was to keep their eyes open to everything which would conduce to safety and comfort, conducting their business upon the lines of a liberal and enlightened policy, the best means, he was convinced, of producing results alike satisfactory to the general public and to those who invested their money in maritime adventure.

TRIAL TRIPS.

Parisian.—The new Allan Liner *Parisian*, of a gross tonnage of 5,050 tons, made an experimental run from the Clyde on February 26th previous to her departure for Liverpool. She has been built by R. Napier & Sons for the Montreal Ocean Steamship Company's Royal Mail service between Liverpool and Montreal. She is 450 ft. long, 46 ft. broad, and 36 ft. deep, and will carry a load of 10,000 tons. She stood high in the water on February 26th, with about 2 ft. of her screw showing, so she was not tried for speed, but her three-cylinder compound engines are constructed to indicate 6,000 horse-power, and to propel the ship from 15 to 16 knots an hour. She has four double-ended boilers, with 24 furnaces. Her hull is constructed of steel, with an inner and outer skin, 5 ft. apart, divided into water-tight compartments, designed for safety, but available for water ballast. She has also 10 water-tight bulkheads. She carries a Trotman and a Martin anchor. The main saloon, accommodating 150 first-class passengers, is placed in the fore-part of the vessel, and so are the state rooms; the second-class state rooms are still further in front.

Nithsdale.—The screw steamer *Nithsdale*, built and engined by Messrs. Cunliffe & Dunlop, Port Glasgow, for Messrs. M'Kill & Co., Glasgow, went her trial trip on the Clyde on February 28th. The dimensions of the *Nithsdale* are:—Length, 240 ft.; breadth, 32 ft. 6 in.; and depth, 17 ft. She has a carrying capacity of 1,650 tons, and is fitted with engines of 130-horse power. She is to be employed in the Mediterranean trade, and has extensive poop accommodation. Special quarters are fitted up amidships for the Officers and Engineers. The vessel left Port Glasgow about noon, with the owners, builders, and a large party of friends on board. On the measured mile she obtained an average speed of 12 knots, equal to about 15 statute miles per hour—a speed which gave complete satisfaction. The modern improvements with which the vessel is fitted include Dunlop's patent governor, for preventing damage to the machinery through the rapid revolution of the screw when raised out of the water by heavy weather.

Penang.—On March 7th the *Penang* (s), built by Messrs. Ramage & Ferguson, Leith, for Chinese owners in Singapore, to the order of Messrs. John Warrack & Co., went out for her official trip with very satisfactory results. With 730 tons dead weight on board, on a mean draught of 13 ft. 1 in., a speed of 10¾ knots was easily attained, the consumption of coal being at the rate of 10 tons per day. On the run down to the Bass Rock a very heavy sea was encountered, and the vessel's sea-going qualities were thoroughly tested to the satisfaction of all concerned. The *Penang* will now shortly leave Leith for Singapore, the crew being all Lascars, sent here specially to sail her out, and on arrival there will at once be placed on the trade between the Straits Settlements, Borneo, Java, and Celebes.

Jane Kelsall.—The screw steamer *Jane Kelsall*, built by Messrs. Readhead & Co., South Shields, for Messrs. W. D. C. Balls and Partners, had her trial trip on March the 10th. She has been specially built for the Atlantic and Indian trades, and classed 100 A1 at Lloyd's under the three-decked rule, with two decks laid, main deck being of iron. Her dimensions are:—Length over all, 275 ft.; breadth, 35½ ft.; depth, 23 ft. Her deck plan is top-gallant forecastle, with iron deck sheathed with wood, and fitted with berths for crew. Bridge amidships over engines and boilers, with engineers' berths, &c. Poop aft with cabin, captain and officers' berths, and a few berths for passengers. She has engines of 170-horse power nominal, supplied by Messrs. John Readhead & Co., and is fitted with patent steering gear on bridge and poop aft. The trial was highly satisfactory, the speed of the vessel averaging 11 knots per hour. On her return to the harbour the vessel was taken direct into Tyne Dock, where she will load a cargo of coals for Genoa, thence to Benisaf and Baltimore. The *Jane Kelsall* will be commanded by Captain Grey, of South Shields.

Ethelbert.—On March 12th the *Ethelbert*, a screw steamer, 170 ft. by 24 ft. 6 in. by 13 ft., having compound engines of 70-horse power nominal, ran the Lights on the Clyde, and attained a speed of 10¾ knots. She is of the highest class at Lloyd's, and has been built to the order of Messrs. A. C. Colvil & Co., Glasgow, by Messrs. Workman, Clark & Co., of Belfast, and engined by Messrs. Muir & Houston, Glasgow. The working of the machinery gave great satisfaction, as also the vessel herself. The steamer is intended for the Glasgow and Mediterranean trade.

Maud Hartmann.—This screw steamer, built by Messrs. Schlesinger, Davies & Co., Wallsend, a few weeks ago, had recently a satisfactory trial trip. This vessel was built for Messrs. Ward and Holzapfel, of Newcastle, and her leading measurements are:—Length between perpendiculars, 260 ft.; breadth, moulded, 35 ft.; depth of hold, 20 ft. 4½ in.; register tonnage, 1,070 tons; and she has a carrying capacity of about 3,400 tons. She classes 20 years in red in the Liverpool Underwriters' Registry, and is in every way fitted out as a first-class ocean-going steamer. The vessel went to sea loaded with 2,382 tons of coals, and her engines were tried with great success, the indicated horse-power being over 700, and the mean speed attained over nine knots. The *Maud Hartmann*, after giving up her visitors to the attendant tug, steamed off for Bombay.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions referred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

To the Editor of the MARINE ENGINEER.

DEAR SIR,—I have been a reader of your valuable journal for some time now, and in comparing dimensions and results of trials in the very interesting columns devoted to "Launches and Trial Trips," I find myself "quite at sea" as to the meaning of various terms used therein.

Several of my fellow-workmen and I would feel ourselves under a great obligation if you would kindly explain the meaning of the following terms:—"gross tonnage," "gross tonnage register," "registered tonnage," "nett registered tonnage." Which of the above does "dead weight carrying capacity" come under? Explain the difference between "tons gross register" and "tons builders' measurement."—Yours very sincerely,

NOVICE.

London, *March 14th*, 1881.

GROSS TONNAGE, *or*, GROSS REGISTER TONNAGE, is the entire *internal* capacity of the vessel in cubic feet divided by 100.

In most vessels several deductions are made from the above;—for instance, the tonnage of the space occupied by the crew, or used for the navigation of the vessel, and in steam vessels a further deduction is made on account of the space occupied by the propelling machinery. The remainder, after all deductions allowed by law are taken away, is called the *register tonnage*, or, *nett register tonnage*, and is the tonnage upon which dues, &c., are paid.

The dead-weight carrying capacity does not come under either of the above heads,—it depends not only on the *external* capacity or displacement of the vessel, but also on the weight of the vessel itself, the weight of machinery, bunker, coals, &c., and weight of stores and equipment, all of which are independent of the *internal* capacity or tonnage of the vessel. For instance, a vessel built very strongly, and consequently heavily, and fitted with heavy and powerful machinery, will be able to carry much less dead-weight than a vessel of precisely the same outside form, but lighter built and fitted with less powerful machinery.

Builders' measurement tonnage is an exceedingly arbitrary and unscientific term:—it depends upon the length, breadth, and depth of the vessel only, and not upon the *form* of the vessel; so that a box-shaped vessel would be the same builders' measurement tonnage as a vessel finely shaped like a racing yacht, with the same length, breadth, and depth.—ED. M.E.

To the Editor of the MARINE ENGINEER.

DEAR Sir,—Will you or some of your kind readers furnish formulæ and results for the HP. of following conditions of a compound steam engine?

1st. Area of cylinder, 144 sq. in.; stroke, 2 ft.; revolution, 1; steam, (85·3 + 14·7) 100 lbs.; cut-off at ·5 (in this cylinder), and 2nd cylinder of double volume.

2nd. All conditions same as 1st, with exception of the 2nd cylinders, but of equal combined capacity of 2nd cylinder of 1st case.—Yours, &c., WOOLF.

Newton, *March 4th*, 1881.

Reviews.

The Practical Guide to the use of Marine Steam Machinery. By Jas. Donaldson. Published by Chas. Wilson, 157, Leadenhall-street.

We have perused this book with much pleasure, as it bears throughout the marks of a practical writer, who does not confuse his readers or himself by attempting high-flown scientific calculations or descriptions. The book abounds with excellent practical hints as to the management and care of marine engines. Many illustrations of launches and engines are given, all from the best and latest examples; and the letter-press is not only merely descriptive of the examples, but abounds in easy rules and calculations applicable to cognate cases. Many of the tables of dimensions, powers, strengths, &c., would be exceedingly useful to a marine engineer. The whole book is excellently and clearly printed, and very tastefully got up.

Wood-working Machinery. By Mr. Powis Bale. Published by Crosby, Lockwood & Co.

This volume is one of the most comprehensive collections of examples and descriptions of all classes of wood-working machinery. There is, of course, a great deal of it of no special interest to marine readers, but as wood still forms so large a part of the structure of many vessels and of their fittings, there are many machines herein described of interest to shipwrights. In especial, Chapter XXVII. deals in part with machines for sawing out ship's timbers to a correct bevel, and an invention of a Mr. Green to ensure accuracy in the bevel, without depending on the eye of the workman, is very interesting. A small diagram of the required bevel is wound round a roller, and a mechanical tracer is made to follow the line of the diagram, and thus ensure a corresponding bevel cut by the saw. Mr. Normand's machine for cutting ship's timbers is also described, and there are many other machines applicable to a shipwright's purpose. The plates and type are excellently clear and good.

How to Manage a Steam Engine. By Mr. Powis Bale. Published by Wyman & Sons, Great Queen-street.

This is a small and handy volume for the information of factory owners, colonists, or others who have to rely on their own probably unskilled services. Most of the different varieties of engines are treated of, and their peculiarities are described. Useful hints about boilers, feed-pumps and fittings are not forgotten, and the work closes with valuable information about gas engines, which are now coming so rapidly into use, and of which we should imagine there is as yet very little written information to be had.

Notes and Novelties.

MR. TH. RODENACKER, of Dantzic, in conjunction with Messrs. Bremer, Bennett, & Bremer, of London, have contracted with Messrs. C. S. Swan & Hunter, of Wallsend-on-Tyne, for a screw-steamer of similar dimensions to the *Annie*, recently built at the same yard for the above firms. The engines are to be constructed by Messrs. Black, Hawthorne & Co., of Gateshead.

THE IRON AND STEEL INSTITUTE.—The programme for the annual meeting of the Institute, on the 4th, 5th, and 6th of May, has just been issued. Mr. Josiah T. Smith's experience as one of the largest steel manufacturers in this country will give his Presidential address an exceptional interest. Mr. Alex. Wilson, of Sheffield, will read a paper on the manufacture of armour plates. The subject of the manufacture of steel and steel plates will be dealt with by Mr. Sergius Kern, of Russia, who will bring before English manufacturers and users of steel, improvements recently practised in Russia; while the experience lately gained in the practical use of steel for ship-building purposes will be dealt with in a paper by Mr. Denny, of Dumbarton. The question of the relative corrosion of iron and steel will be discussed by Mr. Wm. Parker, of Lloyd's. A paper is promised by Captain Jones, manager of the Thomson Steel Works, Pittsburg, on the manufacture of Bessemer steel and steel rails in America.

THE "DUILIO."—The following is an extract from a letter written by an officer, an impartial observer of things appertaining to the Italian Navy:—"I have seen the *Duilio* off Messina in rough weather. While on her voyage to Milazzo she shipped a very small quantity of spray, which was not the slightest hindrance to her artillery service, as she rolled almost imperceptibly, while the *Maria Pia* and the *Principe Amadeo*, on board of one of which vessels I was, scarcely could resist the seas, which caused them to roll and pitch strongly. If the *Duilio* had been an enemy she could have sunk us without firing a shot, unless we had preferred to save her the trouble by going down of ourselves. I do not know what will be the immediate result of the question as to large or small men-of-war, but I doubt not that the superior qualities of our so-called colossal vessels will finally be proved, and future history ought to be very severe with those who, actuated solely by personal motives, injure the development of our means of offence and defence. Meanwhile the *Duilio* has completed her artillery practice, during which the guns behaved admirably." An official trial is soon to be made of the heavy artillery of the *Duilio*. The experiments are to take place in the Gulf of Gaeta.

LIGHTHOUSE DISTINCTION.—At the Society of Arts lately Sir William Thompson read a paper on the subject of the best means of making a lighthouse fulfil its *raison d'être* of being distinguishable at once from a vessel's light at sea or a shore light, and not being confounded with any other lighthouse on the same coast. Sir William brings to his task not merely his highly-trained scientific intelligence, but no inconsiderable practical experience as a navigator, and his conclusion is that the most useful and satisfactory means is to adopt the system of "group-flashing," under which a lighthouse would give a series of groups of flashes, not exceeding four, at very brief entervals, with a sufficiently long period between the groups to divide them beyond the possibility of doubt. He proposes ten varieties, which are sufficient to define all the numerous fixed lights round our coast, made up of long eclipses of three seconds, and short eclipses of one second, with intervals between the beginning of one group and the beginning of the next of ten, twelve, fifteen, and twenty seconds. By means of a model apparatus for producing these occultations and a gas jet, he showed practically how perfectly distinctive signals produced in this way were, and instanced cases in which the principle has been most successfully applied in practise, both by the Trinity House and the Board of Scottish Lighthouses. He insisted on the importance of applying the same principal to the sounds of syrens, or fog horns of lighthouses, adopting Admiral Sir R. Collinsons's suggestions of high and low notes being brought in direct contrast.—In the discussion which followed, Professor Tyndall heartily endorsed the necessity for such means of distinctiveness, declaring that in certain conditions of the atmosphere, a candle in a lanthorn, and the electric light, were undistinguishable by mere appearance. He also announced that the Elder Brethren of the Trinity House were alive to the necessity of this distinctiveness, and were working in that direction.—Very general approval was given to Sir. W. Thompson's proposal, and he received a hearty vote of thanks.

REMOVING OBSTRUCTIONS IN NEW YORK HARBOUR.—The destruction of Hallett's Reef, which formed one of the obstructions of Hell Gate in New York harbour, will long be remembered as a successful piece of difficult engineering work. Since this was removed, General Newton has been engaged upon a similar, but more important undertaking forming part of the same enterprise. This is the removal of Flood Rock, the largest and most dangerous obstruction in Hell Gate, and which will involve a final blast with 200,000 lb. of powder, while the explosion at Hallett's Reef was made with 50,000 lb. of powder. The exterior works are established on the crown of the Flood Rock, which, being below the level of high water, is surrounded with a cofferdam. The works comprise a blacksmith's shop where drills, &c., are forged, a repair shop for the machines employed, boiler-house and pumps. A perpendicular shaft was first sunk through the rock to the level of the horizontal workings, the floor of which is 60 ft. below the high-water level, and about 34 ft. below the bed of the river. From a gallery connected with this shaft 10 tunnels, parallel to each other, and running in the direction of the river, are driven; these are at present 600 ft. long, and are connected by 13 smaller cross galleries. Along the main galleries tracks are laid, and the stone excavated is led on cars to the foot of the shaft, and thence is hoisted and deposited in barges. Some of the excavation was employed to protect the outer side of the dam enclosing the works, but the greater part is thrown into a deep hole in the river close by. Already 783,000 cubic ft. of stone have been removed, and as the work will progress for two or three years longer, some idea of its magnitude may be obtained. The excavation is effected by steam-worked rock drills and blasting. There are 10 drills, each capable of boring 25 holes a day, 4 ft. deep and 2 in. diameter. The blasting is done on the evening of each day, the average rate of progress being about 500 ft. of tunnel per month. It is expected that the preliminary work will be completed in 1883, and that the great blast of 200,000 lb. of powder will take place the same year. A similar system will be adopted to that so successfully used at Hallett's Reef; the workings will be filled with water before firing the charge.—*Engineering*.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 18th February, to 21st March 1881.

721 E. R. Allfrey. Lining steam engine cylinders.
733 W. R. Oswald. Alarum gauges.
746 F. H. F. Engel (communicated by J. D. Möller). Barometers and Manometers.
759 W. P. Thompson (communicated by J. Lallemand). Prevention of boiler incrustation.
767 T. Joicey. Steam boilers.
794 R. Burdes. Boat davits and disengaging gear.
797 R. Whitby. Life buoys.
807 F. Wirth (communicated by E. Goehrung). Aërial, submarine and other navigation.
808 J. Gordon. Bushes for wooden block sheaves or pulleys.
812 J. Lumb. Lubricators.
833 J. Shanks & J. G. Lyon. Steam pumps.
843 H. J. Haddan (communicated by J. Lewis & F. A. Brown). Cards and magnetic needles for mariners' compasses.
850 J. Shanks & J. G. Lyon. Vertical steam boilers.
858 F. A. Bishop. Handling and treating dredged material.
866 T. Moy. Steam boilers.
871 S. S. Hazeland. Rowlocks and oars.
877 W. R. Lake (communicated by J. M. Foster). Gaslight apparatus for buoys, lighthouses, &c.
879 A. Shippey. Electric light signalling.
884 J. G. Tongue (communicated by W. Wurdemann). Marine engine governor.
905 C. T. Wordsworth. Direct acting engines and pumps.
913 W. S. Glover & G. F. James. Twisting and lapping wire, &c., for covering telegraph cables, &c.
916 G. W. Handley. Engines.
930 A. C. Kirk & R. Sim. Preparing ships and other steel structures for painting or coating.
955 L. Boye & E. Müller. Instrument for indicating the density and pressure of steam.
970 F. Foster & H. A. Fleuss. Submarine and safety mining lamp.
978 W. P. Thompson (communicated by International Fog Bell, Co.). Operating fog bells or gongs.
982 L. A. Groth (communicated by A. E. Müller). Propelling apparatus for wholly or partly immersed vessels, &c.
984 C. R. Parkes. Cranes, leads, hoists, capstans, &c.
994 J. Spence (communicated by J. C. Spence). Condensing apparatus.
1019 F. W. Durham. Controlling speed of steam engines.
1033 G. Hunter. Smoke consumer.
1060 R. & F. Garrett. Tubular boilers and furnaces.
1062 W. R. Cooper & J. Taylor. Steam and hand steering apparatus.
1080 B. P. Stockman. Floating bridges.
1087 T. Cockshott & H. M. Goodman. Rotary hawse pipe for moored vessels, for keeping cables from fouling telegraphic cables.
1100 L. A. Groth (communicated by G. Liedmann & C. Berger). Motor for vessels, carriages, &c.
1114 E. T. Jones. Launching life boats and attached lights.
1124 F. J. Burrell & T. T. Burall. Steam engines &c., and steering engines, &c.
1162 J. Swain. Steam generator, &c., furnaces.
1167 J. B. Scarlett. Marine governors.
1185 F. Löbel. Machine guns.
1228 T. Elcoate. Condensation of steam.

*** Any information regarding the progress, &c., of these or other patents will be gladly furnished on application.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.
NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

February 26th, 1881.

Adams Frank ...	1 C	London.
Barber Richard...	2 C	N Shlds.
Belford Wm. ...	2 C	do.
Black John ...	2 C	do.
Bowie P. ...	2 C	Abrdeen
Cock J. ...	2 C	do.
Cane Thomas ...	1 C	Lvrpool.
Clarke Samuel ...	1 C	London.
Caiger Emery J.	1 C	do.
Drewry Thos. ...	1 C	Hull.
Dowey T. G. ...	2 C	N Shlds.
Dunn J. ...	1 C	do.
Emerson Rbt. ...	1 C	do.
Glen Andrew ...	2 C	Grnock.
Granger Jno. J....	1 C	N Shlds.
Hay William ...	2 C	N Shlds.
Henderson Sml....	1 C	do.
Hewson Wm. ...	1 C	do.
Hepburn David...	1 C	London.
Lewis Hugh ...	2 C	N Shlds.
Loughran Edwd.	2 C	do.
Laskey Frank ...	2 C	do.
McBain John ...	2 C	do.
Oates Thomas ...	2 C	Lvrpool.
Potts John ...	2 C	Hull.
Rochester T. N...	2 C	N Shlds.
Ruller William Henry A. ...	2 C	do.
Speers William...	1 C	do.
Speers James ...	2 C	do.
Stafford John ...	1 C	do.
Scott Henry ...	1 C	do.
Shortt Edwd. F....	1 C	do.
Schnack S. F. A.	1 C	London.
Smith Dvd. P....	1 C	Hull.
Smith Alfred ...	2 C	do.
Wilson William	2 C	N Shlds
Wilson James ...	1 C	do.
Wilson James ...	1 C	London.

March 5th, 1881.

Almond Harry J.	2 C	Sndrlnd
Allan J. M. ...	2 C	Hull.
Cave James ...	2 C	Lvrpool
Crisp George ...	2 C	Sndrlnd.
Fraser Dvd. Chas.	2 C	Glasgow
Gray James ...	2 C	Sndrlnd.
Grant Wm. B. H.	2 C	Glasgow
Haldane Jas. T..	2 C	do.
Haxton Archbld.	2 C	Grnock.
Ingram Thos. ...	1 C	Lvrpool.
Lindsay Wm. ...	2 C	Sndrlnd.
Leach George ...	2 C	London.
Morgan George...	2 C	Lvrpool.
Maxwell A. ...	2 C	do.
Macfarlane Jas. L.	2 C	Glasgow
Milne Joseph ...	2 C	do.
Muirhead Gairn	2 C	do.
Paterson Alex. D.	1 C	London
Rennie Francis ...	2 C	do.
Shortt D. ...	1 C	Hull.
Seabury E. ...	1 C	Sndrlnd.
Stalker Robert ...	2 C	Glasgow
Stewart Alex. ...	2 C	do.
Wise J. E. D. ...	1 C	do.

March 12th, 1881.

Anderson Adolphus ...	2 C	N Shlds.
Bell William ...	2 C	do.
Burrell Edward ..	2 C	London.
Bowden A. J. ...	1 C	do.
Clarke Jas. R. ...	2 C	Plymth.
Craig John ...	2 C	Lvrpool.
Cowell Philip ...	1 C	do.
Duncan Geo. ...	2 C	N Shlds.
Evens Robert ...	2 C	Lvrpool.
Hall Sidney ...	1 C	N Shlds.
Hall Thomas ...	1 C	do.
Hardie William...	1 C	do.
Hebden Sylvester	1 C	do.
Jamieson Rbt. ...	2 C	London.
Lee James A. ...	2 C	do.
Little Robert ...	2 C	Lvrpool.
Mancor Jas. H....	2 C	do.
McAndrew John William ...	2 C	Hull.
McEvoy George...	2 C	London.
Nixon E. ...	2 C	N Shlds.
Pearson Robert...	2 C	do.
Richardson Andw.	1 C	do.
Roberts Hamilton	2 C	Plymth.
Taylor James ...	1 C	N Shlds.
Toovey A. F. ...	2 C	London.
Thomas R. P. ...	2 C	Bristol.
Wilson Alfred ...	2 C	Leith.
Wattley William Henry ...	2 C	N Shlds.
Walker John ...	2 C	do.

March 19th, 1881.

Black James ...	2 C	Grnock.
Dunn Peter ...	2 C	N Shlds.
Driver Joseph ...	1 C	do.
Hellon Richard...	2 C	Hull.
Hewitt Fredk. ...	2 C	N Shlds.
Kilvington Jas.	2 C	do.
Kelso George ...	2 C	London.
Lang William ..	1 C	Grnock.
Nicholson Fredk.	2 C	London.
Peattie James ...	1 C	Grnock.
Spencer Thos. E.	1 C	London.
Thomas John R.	2 C	do.
Williams William John ...	2 C	N Shlds.

ROBERT JACKSON, Registrar-General.
General Register and Record Office of Shipping and Seamen
32, Basinghall Street.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

ADVERTISEMENTS.

All Advertisements and Business communications must be addressed to the PUBLISHER, 3, Amen Corner, Paternoster Row, London, E.C., to whom all complaints respecting irregularities in delivery should be addressed. Advertisements must be sent in not later than the 25th of each month to ensure insertion in the following number.

SCALE OF CHARGES.

Official Announcements, &c.	1s. per line.
Trade Advertisements	9d. " "
Displayed Advertisements, per Inch single column . .	5s.
" " " " double " . .	10s.
" " " " treble " . .	15s
" " ¼ page	30s.
" " ½ " . .	60s.
" " Whole page . .	120s.

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All Accounts are to be remitted to the Office, 3, Amen Corner, Paternoster Row, London, E.C.

SUBSCRIPTIONS.

The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer,

LONDON, MAY 1, 1881.

EDITORIAL NOTES.

THE dangerous explosions of gas, to which coal-carrying vessels are so liable, have at last received the earnest attention of the Marine Department of the Board of Trade. There is no better precaution against such explosions, known at present, than thorough ventilation. With this view the Board draw especial attention to their recommendation that "free and continuous egress to the open air independently of the hatchways, should be provided for the explosive gases by means of a system of surface ventilation which would be effective in all circumstances of the weather." Not only, however, does he Board direct attention to this recommendation, but enforces it by warning certificated masters and officers that neglect on their part in the case of accident, would be brought before the notice of the Wreck Commissioner or of the Court investigating the case. The shipowners are also not overlooked, but are advised that it is the intention of the Board to prosecute those persons who in future send or take to sea British coal-laden ships which, on account of insufficient or improper ventilation, are in such an unseaworthy state that the life of any person is likely to be thereby endangered, and all persons who so neglect their duty in respect of ventilation as to cause danger to life or limb. This is pretty hot for both masters and owners, but after the conclusive evidence given before the Royal Commissioners appointed to enquire into the spontaneous combustion of coal in ships, it is scarcely to be wondered at.

MANGANESE BRONZE seems to be the metal of the future. It appears to have fully one hundred per cent. greater tenacity than gun-metal, and an equal increase of elasticity. For propellers this is an incalculable advantage. The elasticity of the blades of a propeller would be all important in preventing jar and vibration upon the shaft and engine. The thinner section that might be used would also offer less surface and resistance to the water, whilst equalling the strength of a gun-metal blade of much thicker proportions. A propeller of this metal is about to be fitted to the *Colossus* instead of in gun-metal as at first ordered. This decision has been arrived at after a series of conclusive experiments on comparative bars of gun-metal and Manganese bronze of the same section. Bars of one-inch square were placed on supports twelve inches apart, and first subjected to a steadily increasing pressure on the centre of the bars, and afterwards to the impact of a weight of fifty pounds falling through a height of five feet. The gun-metal bars either broke or slipped between the support by doubling up at a steady strain of 28 cwt., whilst the Manganese bronze bars required 54 cwt. to effect the same result. When tested by impact, seven to eight blows were sufficient to break down the gun-metal bars, whilst the Manganese bronze withstood thirteen to seventeen blows. The ultimate bend of the

Manganese bronze was also in both cases greater than that of the gun-metal, thus showing greater toughness as well as double the strength in the former than in the latter.

Sir John Hay seems to have but a poor opinion of the present state of the British Navy. He considers that England's safety requires a minimum of at least sixty-two ironclads, whilst at present we are not blessed with more than forty-one. France alone, it seems, have more ironclads than we, which seems in Sir John Hay's opinion, to seriously threaten England's assumed position of "Mistress of the Sea." He seems to forget that in olden times it was not an excess in numbers, but the superiority in pluck and efficiency that gave us the many naval victories of which we are now so proud. We do not think our supply of seamen is in half so satisfactory a condition as the supply of ironclads. We have only in our navy, 18,500 seamen and some 12,000 naval reserve. In the case of a war requiring the co-operation of our navy, it appears to us that it would be more difficult to successfully man a large increase of our cruising navy, than to find suitable fast steamers from the mercantile marine to reinforce our naval power. Such a large proportion of the seamen serving in our mercantile marine are foreigners or Lascars that we could in no wise rely upon that body for serviceable recruits. There is so little inducement held out to good seamen or engineers in the mass of our mercantile marine, that we cannot be surprised at the large proportion of foreigners and disreputable characters manning our cargo vessels.

The American Continent is a country of gigantic scenery and possibly of correspondingly gigantic enterprises. We see that they possess what we should suppose to be the largest ferry boat in the world. The vessel called the *Solano* plies at the mouth of the Sacramento river in Californa, and forms a connecting link in the Grand Central Pacific Railway, carrying over trains from Benicia to Port Costa on the direct route from Sacramento to San Francisco. The length of the deck is 129 metres, and the width of the platform nearly 35½ metres. The draught of water (when loaded) is about two metres, and the tonnage is 3,600. These dimensions are so considerable that the vessel can carry four lines of railway abreast which will accomodate forty-eight wagons with their locomotives, or twenty-four passenger cars of the American type. The *Solano* is a paddle vessel, with paddle wheels 9·14 metres in diameter, which are independent of each other, and each is driven by a vertical beam engine of 2,000 horse-power. These paddles are not placed outside the vessel, but are placed behind each other in the longitudinal axis of the vessel. The vessel is steered either way by four balanced rudders worked by hydraulic apparatus driven by independent steam engines.

We regret to see that a valued contemporary journal from which we, last month, published a considerable extract upon the Navy Estimates, as presented to the House by Mr. Trevelyan, does not seem to consider that there is much ground for the present feeling of the engineers of the Royal Navy, as to their inferior status compared with the combatant officers. It is not that this grievance is not generally known to exist, but this journal considers that the acknowledged inferior status of the engineers is due to their personal inferiority in education and social standing. We would beg emphatically to remark that it is this very want of social recognition that debars many of the best nurtured and educated naval engineers from remaining in the service when they can have a good opportunity to get out. Of this we know many forcible instances amongst personal acquaintances. The surest way of securing gentlemanly and well educated engineers for the service, is first to acknowledge them as such. On another point also we must greatly demur to the statement of the said contemporary that the naval engineers' position is more suited to the practical artizan than to the educated gentleman. As the success of any marine battle will now almost entirely depend on the condition and success of the engineering appliances on board, we cannot in any way agree to the opinion that the naval engineers' position is not one requiring brains and education. To our mind this is more a necessary qualification to the engineers than to the combatant officers, since the work of the former is more technical and scientific. In the case of sudden break down by weather or shot, the whole safety and power of the present iron-clad would depend upon the ingenuity and skill of the engineer officers for a temporary refit. Such impromptu work is essentially that of a designing, inventive, and educated mind of the highest order. To the suggestion also of our contemporary that one such educated engineer would be sufficient with surbordinate foremen, we think a sufficient answer to that lies in the perils of warfare, requiring several suitable subordinates ready at once to step into their leader's place in case of accident.

The failure of the steel plates of the boilers of the *Livadia* have given rise to a great deal of uncomfortable doubt as to the reliability of steel plates for boilers. This is a most important subject, as so many boilers are already built of steel plates, and the number is daily increasing. The confidence of boiler makers in steel plates is at present so great that we find them specified for the crowns of fire-boxes in place of the best Lowmoor. The faith of such boiler makers must have received a very rude shock, not only from such an unaccountable failure as that of the plates of the *Livadia's* boilers, but also from a circular just issued by the Admiralty. We call the failure of the *Livadia's* boiler plates unaccountable because the plates had answered every test for tensile resistance and ductility most admirably. It is almost impossible then, with our present knowledge, to form an idea how a perfectly ductile material can have developed a crack twelve inches long in a half-inch plate without having been subjected to any severe strain. The Admiralty circular to which we have referred may throw some light on the matter. It appears from Government tests embodied in this circular that steel loses its ductile and tenacious properties at a very low temperature, in fact little higher than that of ordinary high pressure steam. At such temperatures it is found that the steel plates cannot be bent without fracture. This is a startling statement, and if found to be generally true, the worst possible place to which steel plates could be fitted, would be over the fire in the fire-box crown. At any rate for the future no *cold* tests of steel boiler plates can be accepted as any evidence of its ductile or tenacious qualities when at the ordinary temperature of a boiler or of a crown plate. These facts will not militate in any way against the value of steel for shipbuilding purposes. It is only to boilers that the value of its application is to say the least, at present very doubtful.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual meeting of the Institution of Naval Architects for 1881 was held on the 6th, 7th, and 8th of last month, in the Hall of the Society of Arts, John Street, Adelphi. The president, the Earl of Ravensworth, filled the chair. The proceedings commenced on the 6th with the transaction of the general business of the Institution, such as the election of the Council and of new members. The annual report of the Council was then read. The Council deeply regretted having to announce the death of Lord Hampton, the late President of the Institution. Lord Hampton, who only resigned at the close of the last annual meeting, had been president of the Institution ever since its foundation in the year 1860. His lordship's services are fresh in the memory of every member and associate, and the best testimony to them is the flourishing condition in which he left the Institution. The Council was glad to be able to report that the funds of the Institution continue to be in a satisfactory condition. Acting upon a generally expressed wish the Council has, during the past year, caused the preparation of a General Index of the twenty-one published volumes of Transactions. This index is now completed, and will be shortly on sale at the price of ten shillings to the general public, and only five shillings to members and associates of the Institution. At the invitation of the Lord Provost of Glasgow and of the committee of the Naval and Marine Engineering Exhibition, a deputation from the Council proceeded to Glasgow in November last, in order to represent the Institution at the opening of the Naval Exhibition. The deputation is of opinion that exhibitions similar to that now being held in Glasgow are, when systematically organised, of great interest and utility, and might with advantage be held at fixed intervals of time.

After some further business of a general character had been transacted, the president proceeded to address the meeting. He said that at this time last year he had hoped that upon this occasion he should be able to congratulate them upon a general and decided revival of trade. These hopes had not been realised. The excise and revenue estimates, which were the best indications of the general condition of the people and their consuming power, showed a deficit upon the year, and in the last quarter it was the most unfavourable of the whole year. The railway traffic returns also were very accurate indications of the general condition of business; and trade in the country showed a serious falling off the last quarter, which was by no means satisfactorily accounted for by a bare reference to the rigorous winter, out of which we seemed hardly yet to have emerged. But though the general condition of trade was bad, there had been progress noted in certain branches in our trade from time to time during the year; but the progress, where it had been observed, had been fitful and fluctuated, and truth forbade him to offer them cordial congratulations upon the present position of trade. True, there was no ground for despondency, and they must still continue to hope; but they had been hoping for five or six years, and they all knew the old saying, "Hope deferred maketh the heart sick," and he was afraid that these words were rather applicable at the present moment. But though the general condition of trade was by far from being what they wished it, there was one branch of our national industry about which there was no mistake, and which he thought, if his opinion were credited, left little to desire, and that happened to be the industry in which they were all interested, and many or most of them personally engaged—he meant the shipbuilding interest in this country. He had seen it described, and he believed pretty accurately, as being at the commencement of this year in a state of feverish activity, and the only possible point that anybody could urge, was that it might be a little too well, for they all knew that when they had a plethora of tonnage it meant low rates of freight and disappointment and loss. He trusted that that might not be the case in this instance. But it might be well to be reminded of the magnitude and importance of the shipping interest in this country. There had been invested in the shipping interest in this country one hundred millions of money, and there were employed two hundred thousand men, who earned 10 millions of wages annually, and besides these there were one hundred thousand men employed in our shipbuilding establishments and marine engineering works, earning wages to the annual amount of seven millions of money. He thought he was justified in calling this a mighty industry. In peace the shipping interest in this country largely fed our teeming multitudes of working men.

The shipping was the most important national industry, with the one exception of agriculture. So much for its importance in peace. But they were aware that the foresight of governments had secured for the service of the country, both at the period of construction, and afterwards, the service of those magnificent steamers which form the great ocean liners which convey all the vast commerce to our shores. Their decks were strengthened and they were capable of carrying heavy guns, and would be manned by seamen trained to the use of those guns. They might picture to themselves the start that this would give us supposing they were to be engaged in a war directly with any one or two great maritime nations in the world. He ventured to think that that was a start in which they would find considerable difficulty in catching up. This mighty industry was in a state of very great prosperity, and he would give them a few figures to show them. He would speak of the northern ports, because he was personally acquainted with them. He found the Clyde held her honoured position at the head of the list, having built last year one half more tonnage than she did in 1879, and 1879 was a very fairly active ship-building year all over the kingdom. The Wear built one-third more than in 1879; the Tees more than 50 per cent. increase over 1879 ; the Tyne only built one-tenth more, and she actually built 21 vessels fewer, but she built upwards of 10,000 tons more shipping than in 1879. Now that was important, because it showed that the efforts of our shipbuilders were directed to larger and more powerful and consequently swifter vessels. The figures were as follows :—The Clyde built in 1879, 191 vessels with 168,460 tons ; in 1880, she built 209 vessels and 236, 579 tons. The Tyne built in 1879, 130 vessels and 139,843 tons in 1880 she built 109 vessels only, but with 149,082 tons. The Wear built 65 vessels in 1879 and 92,176 tons, and in 1880 77 vessels, with 116,227 tons. The Tees built 25 vessels, with a tonnage of 31,756, and in 1880 38 vessels, with 48,506 tons, and the value of the vessels in the north-eastern ports built last year amounted to seven millions of money. Just to illustrate the strides that were being made in our shipbuilding establishments he would give one illustration. There was a little port called Blyth which the other day was only known as a coal port. There was launched a fortnight ago from that little port a fine powerful steamer of 2,500 tons, and classed A1 at Lloyd's, and that was the sixth vessel turned out from that active establishment within the last twelve months. No doubt the cheapness of material would afford some explanation for this remarkable activity, and he had gone somewhat closely into the prospects of shipping and the orders received by different establishments, and he had come to the conclusion that the only relaxation of this remarkable activity would be caused by the rise in the price of material.

A writer in the *Economist*, writing on the 5th February last, said he had ascertained from documents which had never been contradicted that there were at that moment building in the various shipbuilding establishments in this country no less than 650,000 tons of shipping under Lloyd's rules, and in addition to that there were 150,000 tons more not under Lloyd's qualifications, making a total of not less than 800,000 tons of shipping in course of construction in February last. Now there was another remarkable statement made. Mr. Pearce delivered a lecture in Glasgow a short time ago, and he brought out a remarkable fact that our steam fleet had increased since 1850 from 1350 vessels to 6690 vessels, representing 2,730,000 tons of shipping, or one million more tons than of all other steamships of the world put together. He was therefore justified in saying that we held a very fair position in the carrying trade of the world, and might justly be called the shipbuilders of the world. It might be interesting to follow this up by reference to our relative position to other great maritime nations, friendly and rival, in this mighty competition in this matter of ocean carrying. He would take his figures from an able writer in the *Atlantic Monthly* who was calling attention to the serious position of American shipping at this moment. He said our ships actually carried less trans-oceanic freight than they did three years ago, and far less than at any time during the last thirty years, the period of the Civil War alone excepted. In large ocean sailing vessels America holds a fairly good position, and England stands first on the list with 1,276 ships out of a total of [4,682. America stands next with 884. Norway is very close to America with 882.

France has only 57. That probably might account for that remarkable commercial policy upon which France appeared to be embarked at this moment, upon which he would say a word shortly. But when they turned to the ocean steam tonnage they were in a very different position indeed. There was a total of 590 steamers engaged in the trans-oceanic trade, and of that number England had 447 and America had only 46, and of that number 14 only were trans-oceanic strictly speaking, 32 running to the West Indies and South America, which might be called the American coast trade. The writer went on to say that the tonnage of the American Mercantile Marine might be thus estimated: 25 years ago the United States carried 75 per cent. of their own trade in their own ships. Steamers are monopolising the carrying trade, and of the 156 millions' worth of produce exported from New York to England, 140 millions' worth was now carried by steamers. There had been published a Parliamentary paper or report by Sir E. Thornton, relative to the measures submitted to Congress for assisting the shipping interest of the United States, and there is a statement made to the Senate of the United States by Mr. Beck, the Senator for Kentucky, on this subject. He says there is not a single iron sailing vessel to-day bearing the American flag, while iron ships are commanding much higher rates of freight than the best wooden ships, and a very large proportion of the heavy tonnage of the world is yet carried in sailing ships. There is not a single American steamship that crosses the Atlantic Ocean from the great port of New York, and there is not likely to be for years to come, unless we repeal our navigation laws. Thus there was this very remarkable circumstance. Mr. Beck said that while the Americans built in 1879 43,000 tons of registered tonnage there were sold to foreigners 37,000 tons, abandoned 24,000 tons, and lost 87,000 tons, making a total of 148,000 tons. Comparing the loss with the tonnage built, they would find that the losses were double the amount built. Now their lowest varied from 70,000 to 100,000 tons per annum, and they had at the stocks no less than 800,000 tons of shipping.

These were stern facts, and the fact of the matter was that America had protected her commerce of the sea, and her only chance, as Mr. Beck said, for the Americans to recover the position to which they were entitled was to free their shipowners and allow them to purchase their ships in the cheapest market; and if they did that he did not think they should have much ground for alarm, because no one could doubt that we could construct cheaper and better ships than any nation in the world, and the consequence was that, if the navigation laws of America were swept away, our shipowners would receive large orders from America. There was one remarkable statement of Mr. Beck's with reference to the grain fleet. The great bulk of our supplies of food from abroad came from America, and Mr. Beck says:—"The grain fleet despatched from New York last year numbered 2,987 vessels, carrying 102,312,568 bushels of grain, of which 1,075 were steamers carrying 42,426,535 bushels, the remaining 1,822 being sailing vessels carrying 59,892,033 bushels. All of this tonnage includes not one American steamer, and only 74 American sailing vessels. It is estimated that over one hundred million dollars are paid for foreign vessels in the shape of freight, and the great bulk of 75 per cent. is paid to England." The great event of the past year had been the great progress and the immense development of the steel manufacture, and its increased application to shipbuilding purposes. A deputation from the Institute had been at Glasgow, and nothing more delighted and impressed the deputation than the magnificient establishment of the Steel Company of Scotland. They saw an ingot of steel drawn from the furnace and converted in one heat into a boiler shipping plate, as bright as a mirror, a miracle of science and ingenuity which he did not think could well be equalled.

They had an opportunity also of visiting the *Servia*. Her tonnage was 8,500, and she was calculated to carry 3,000 tons of deadweight; she carried 2,000 tons of coal and 1,000 passengers, and she was estimated to steam 17½ knots an hour, and in that connection he might mention that the *Orezon* had crossed the Atlantic in seven days and eight hours. There were two lessons to be derived from that. One was that high pressure was not a source of danger, and that steel was a source of great safety to life, and was an invaluable material for shipbuilding purposes, combining as it did strength with lightness, and great elasticity besides. He knew that some high authorities thought that steel was the material for the future, both for our merchant and for our war vessels, but at the same time they must remember that price has a great deal to do with material, and the present price of steel would probably for some time to come be a serious impediment in its employment for the ordinary ship and rougher description of merchant vessels; but these were eminent authorities, and he was rather disposed to be with those who considered that the days of iron for shipbuilding purposes were numbered. He wished to quote a fact from the chairman of the Cunard to show the advance in Cunard ocean steamers. He said that when the *Britannia* made her first voyage, forty years ago, she measured 1,139 tons, cargo capacity 225 tons, and she steamed 8½ knots. He had given them the dimensions of the *Servia*, and she was calculated to steam 17½ knots. Well, that was no slight progress to be made in forty years.

He had alluded in passing to the French bounty system, which had lately been passed by the Senate, and to show the determination and the unanimity of the French nation upon the subject, that motion was carried by 265 votes to 5. He did not wish to attach much importance to this bounty system which France had adopted. They all knew that bounties were taxes upon the community for the benefit of the few. They knew that bounties were enervating, because they taught or induced those who received them to trust more for profit to the action of the bounty than to their own enterprise and intelligence. But, at the same time, so long as the majority of the nation chose to pay the piper it would be so; but it would not do for British shipowners to view this matter with entire indifference, and he could show them reasons for that. The French bounty operated in two ways. It was a bounty upon the first cost of the vessel, and the amounts had been variously estimated to very nearly one-fifth of the cost. Supposing a vessel to cost £50,000, the bounty would amount to something very near £12,000. But there was another branch of it. There was a bounty upon the navigation of the vessel amounting to one franc and a half per registered ton per thousand miles run on any direct line. Now, that had been calculated to amount in one year to 17½ per cent. upon the first cost of the vessel; and he would put the navigation bounty at 12½ per cent. more upon the navigation which amounted to no less a sum than 30 per cent. of the capital invested in that ship in one year. The effect of that appeared to him to be to put absolutely at least half that amount into the pocket of the shipowner in the shape of profit; and it was very like handicapping a superior horse in a race by putting two stones more upon his back, which was sure to give the advantge to the inferior horse. This was a great epoch in the history of shipbuilding in this country, and he thought he had proved that the condition of that industry left little to be desired.

His lordship concluded his address as follows :—"To what have we to look to maintain this proud position, even, if it be possible, to improve it, as the great ocean carrier of the world. We cannot look to bounties; we cannot look to subsidies; we cannot look to protective or retaliatory measures of any sort or kind. All this sort of legislation and these devices belong—or, rather do not belong—to that commercial policy which the nation has solemnly and deliberately adopted. We cannot look to artificial means, but we can look, and we shall look, with a confidence which the experience of the past completely justified, to the energy, and the pluck of our shipowners, to the ingenuity and skill, and educational and infinitive powers of our naval architects. We must look to them for increased mechanical appliances for the saving of labour, both in our shipbuilding establishments and in the navigation of our vessels at sea. We must look for economy of fuel in the use of improved compound steam machinery, and consequently a larger cargo carrying capacity in our vessels. We must look to them for increased speed and punctuality in navigation, and greater facilities in loading and discharging cargoes, and last, but certainly not least, we must look to greater care in the conduct of experiments upon designs in our shipbuilding establishments in order to bring ingenuity and theory to the test of practice. These are the objects and purposes of this Institution and it is in the fulfilment of this great purpose that you will gain for yourselves that to which I think you are fairly entitled, the title, namely, of one of the most useful and practical institutions in the country."

ON THE PECULIARITIES OF BEHAVIOUR OF STEEL PLATES SUPPLIED FOR THE BOILERS OF THE IMPERIAL RUSSIAN YACHT, "LIVADIA."

By W. PARKER, Esq., Chief Engineer Surveyor of Lloyd's Register; Member of Council.

[Read at the Twenty-second Session of the Institution of Naval Architects, April 6th, 1881; the Right Hon. the Earl of RAVENSWORTH, President, in the Chair.]

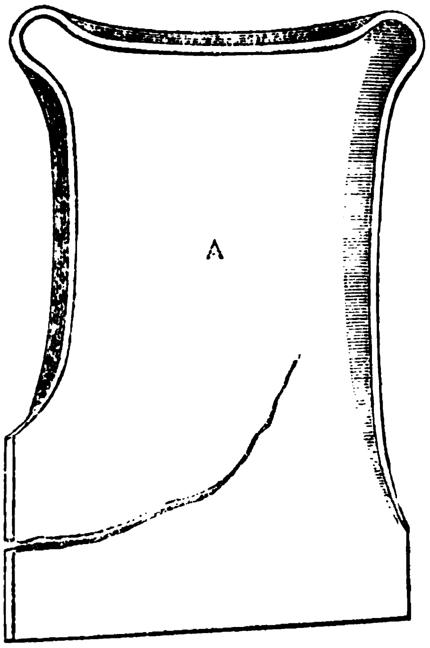
AT the annual meeting of this Institution in 1878 I had the honour to read a paper on the "Use of Mild Steel for Marine Boilers," and I then ventured to shadow forth that when greater care and attention came to be bestowed by our workmen in the manipulation of this material it would to a great extent, if not altogether, take the place of iron for such purposes. At that time there had been only two marine boilers of the modern form made of mild steel, but the manifest advantages this material offered over iron rendered its extensive application evident. Its great strength enabled a reduction to be made in thickness to the extent of 25 per cent. from that required in iron, or keeping the same thickness an increase of pressure of 33 per cent. Its great ductility and general uniformity had also, it will be remembered, been demonstrated by innumerable experiments embodied in papers read before this and kindred institutions.

A few statistics on the progress of the use of steel for marine boilers since the date above mentioned may not be without interest. Within the twelve months subsequent to that date 120 steamships had been fitted with boilers made of this material, and during the same period in the following year 280 vessels had thus been fitted, representing over 600 boilers, while up to the present time no less than 1,100 steel boilers have been constructed, and are now in use in steam-ships, representing a total weight of over 17,000 tons of material.

In the days of its early application two points remained open to doubt by many people, and were the cause of some hesitation as to the development of steel in this direction. One related to corrosion, which does not properly come within the scope of this paper, and the other related to the possibility of brittle steel plates finding their way into boilers, and thereby becoming a source of danger. On the latter point I may state at once, on my own experience, and on the authority of all the Engineer Surveyors of the Society to which I have the honour to belong, that not one single instance of a *brittle* steel plate has come under our notice during the manipulation of these 17,000 tons of steel; and it was not until the peculiar behaviour of the plates of the *Livadia's* boilers occurred that we had any fear on the score of brittle plates.

During the construction of these boilers, and especially during the first year, we often heard of mysterious fractures in steel plates which had stood all the tests required, been rivetted up into their places, and had then, as it was termed, *cracked without being touched*. A great number of these cases have been investigated, and in every instance they have been clearly traceable to improper manipulation of the material, and the plates in the vicinity of the fracture were found to be perfectly ductile after the fracture had relieved the strain upon the material. These cases were quite as numerous in steel manufactured by the Siemens process as by the Bessemer process. Figures A and B will show two plates which have thus torn, and which had been locally heated for the purpose of flanging.

Bessemer Steel.



Tube Plate of a Marine Boiler.

Fractures of this kind at one time used to cause some anxiety, and they have been over and over discussed at meetings of this and other institutions. They were clearly shown to be due to internal stresses set up in the plates by improper manipulation, and under certain conditions a tearing action was set up. As Dr. Siemens put it at the meetings of the Iron and Steel Institute in 1879: "A tear meant applying the whole of the force available upon absolutely one point of the metal. At that one point the metal might be capable of stretching even 50 per cent., but this would not save it, inasmuch as the force was confined to a point. At that point it would tear, and afterwards at another point, and so on. All these mysterious fractures reported might in nearly all cases be attributed to tearing action, which was generally set up at rivet holes if the rivets at those holes took more than their due proportion of the strain." Another illustration given by Dr. Siemens was that of a strip of india-rubber slightly nipped with a pair of scissors, and then stretched, when it would tear right across from the point of discontinuity.

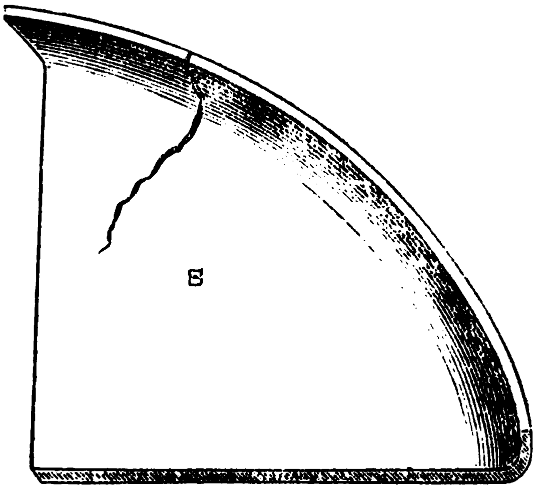
Now I may state at once that the fractures of the steel used in the boilers of the *Livadia* are entirely different from anything we had previously had experience of, and, what is more, we have still later experience of other steel behaving in the same way, and I think the time has come when steel-makers must sift the matter to the bottom, and not only find out the cause, but find out the remedy.

When it became rumoured that the steel used by Messrs. John Elder & Co. in the construction of the boilers for this vessel had given way while the boilers were under hydraulic test, I obtained permission to investigate the matter as thoroughly as I could, as it was felt that unless the reason of the failure in this particular instance was ascertained, the uncertainty as to its cause might not only retard the more extended use of mild steel, but would throw considerable doubt upon the safety and efficiency of boilers already constructed of this material.

Messrs. John Elder & Co. kindly afforded me an opportunity of inspecting the boilers which had ruptured, and in addition to this they very willingly gave the fullest information in their power bearing upon the case, and were good enough to send to London a large portion of the plates which had actually fractured, so that experiments might be made thereon. I also had an interview with Messrs. Charles Cammell & Co., of Sheffield, the manufacturers of the steel in question, and Mr. Alexander, on the part of that firm, stated that they were unable to account for the failure of the material, and in the interests of every one concerned would like to have the matter fully and impartially investigated.

It appears that the plates were specified to be Messrs. Cammell's subcarburised steel, made by the Siemens process, each plate to have a tensile strength of not less than 26 and not more than 30 tons per square inch, with an ultimate elongation of 15 per cent. in a length of 6 inches. In all there were 154 plates supplied, and from these 219 pieces were cut for bending tests; the cold bending and temper tests were made—and were nearly all satisfactory when made—from the rough shearings, and in those cases where the rough sheared pieces broke before bending to the required curve, duplicate test pieces were planed and properly prepared, when they all proved to be satisfactory. There were also 14 tensile tests made at the works, the tensile strength varying between the limits of 26·1 and 28·3 tons per square inch, the elongation in 8 inches varying from 27·3 to 34·3 per cent.

Siemens Steel.



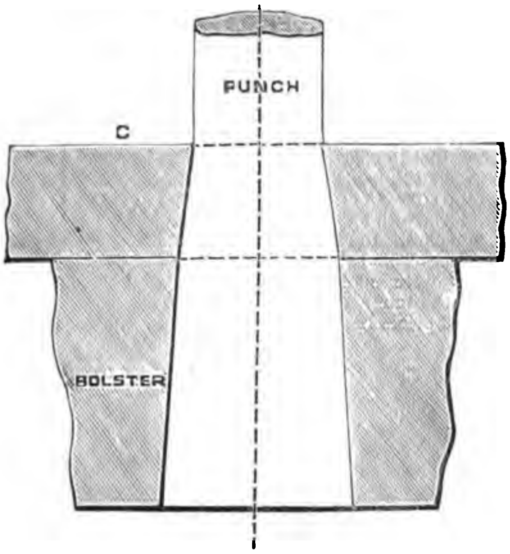
Back End of a Marine Boiler.

On the arrival of the plates at Glasgow, Messrs. Elder, for their own satisfaction, had some check tests made, which practically corroborated those previously made at the steel works. The details of these tests are shown in Table B. It will be seen from these tables that so far as tenacity and ductility are concerned the plates appear to be all that could be desired.

The *Livadia*, it may be mentioned, was intended to be fitted with eight double-ended and two single-ended cylindrical boilers, each of 14 ft. 3 in. diameter by 16 ft. long and 8 ft. 6 in. long respectively, constructed to work at a pressure of 70 lbs. per square inch, the shells being of steel, and the internal portions of iron. The shells were $\frac{3}{4}$ in. thick, made in three courses of plating—lap-jointed, treble-riveted in the longitudinal seams, and double riveted in the circumferential seams, as shown in Fig. 4 appended, and would, I may observe, be eligible, by the Rules of Lloyd's Register for determining the safe working pressure in marine boilers, to work at a pressure of 75 lbs. per square inch.

Judging from the results of investigations into previous fractures, the first inquiries that would naturally occur to anyone were, whether the plates had been punched, whether they had been annealed after punching, whether they had been locally heated and if so whether they had subsequently gone through the process of annealing. On visiting the works of Messrs. Elder & Co. I was informed that the plates were all punched, the holes being about $\frac{1}{16}$ in. less diameter than that of the rivets, then slightly heated and bent to their required curvature, and afterwards put together and the rivet holes rimed out fair to the finished size in place. Fig. C gives a full sized sketch of the punch and bolster employed in the present instance.

Figure C represents the Punch and Bolster used by Messrs. Elder.



I was also informed that while under this treatment one of the plates accidentally fell from the slings on to a piece of metal which indented it considerably, but did not crack or injure it in the vicinity of the indentation, but it was observed that the plate had cracked at a number of the rivet holes. Messrs. Cammell were in consequence communicated with, and Mr. Alexander, their representative, who examined this plate, gave it as his opinion that the plates had all been injured by punching, and should be properly annealed to restore the material to its normal condition. Accordingly the plates were all sent to the maker's works at Sheffield, and annealed in a furnace which had been specially altered for this purpose. A sketch of this furnace, and of the position of the plates while being annealed (see Fig. 1). The plates were afterwards returned to Glasgow, and riveted up in their places, and the boilers completed without any further cause for alarm.

On subjecting the first boiler to the hydraulic pressure, before the test pressure of 140 lbs. per square inch was reached the boiler shell tore asunder in three places, the cracks appearing to have started amongst the rivet holes of the longitudinal seams, and to have extended at the back of the rivet holes across the plate (*vide* Fig. 4). In the second boiler, which it was intended to test, the shell plates were found to be cracked in a similar manner behind the rivet holes, *before any water had been put into the boiler*. Mr. Bryce, the manager of the Engineering Department of Messrs. Elder's works, at once gave instructions to cut the whole of the steel shells from these boilers, and they were replaced by others made of steel manufactured by the Steel Company of Scotland. These plates, which were worked in precisely the same manner, gave no special trouble in working, and the boilers proved to be satisfactory under test.

On examination of the cracked or torn shell plates they were found to be extremely brittle; large pieces were easily broken off in my presence by one blow from an ordinary sledge-hammer. In other words, here was a material which had satisfactorily withstood all the mechanical tests recognized by Lloyd's Register, the Admiralty, and the Board of Trade, as sufficient to determine its suitability for the purpose for which it was being used, and was now shown to have become as brittle as cast iron, or even more so, after having apparently undergone only the working usual in boiler-making.

Many causes were hastily assigned for the remarkable change the steel had apparently undergone during manipulation, and all more or less plausible. These possible causes were investigated as rigidly as was possible.

1. It was suggested by some that the steel contained too much silicon, sulphur, or phosphorus, or that perhaps the carbon was too high, and that chemical analysis would clear it all up.
2. It was suggested by others that the material could not have been made by the Siemens process, but must have been produced by the Bessemer process, and possibly had been overblown.
3. It was suggested also that the material might have changed its nature during the process of annealing, and that brittleness might have been induced by the absorption of gases in the annealing furnace, which would be contained in the material in an occluded state; or that perhaps the edges of the plate had been burnt during the process of annealing.
4. It was finally suggested that the cause might be traced to the action of punching or riveting, assuming all the tests that had been made to be *bonâ fide*.

Accordingly chemical analysis was resorted to as being likely to throw some light on the subject, and I must say that in this instance I was most fortunate in obtaining the co-operation of several of the most eminent metallurgists and chemists in the kingdom, who have kindly furnished me with careful analyses of samples of the material, and have also given me valuable hints and information in the course of this investigation. The results are set forth in Table C, which also contains the analyses previously made for Messrs. Elder by the Glasgow City Analyst, together with analyses of steel of different Companies' manufacture which has not given trouble in working. Although there are one or two points of difference in the results they may be said to fairly agree, and they do not show any reason why the material should behave in an anomalous manner; and considering that the raw material used was thus shown to be of suitable quality, it became necessary to look either to the mechanical treatment by which the ingots and slabs were converted into plates, or to the subsequent treatment which the plates have undergone.

When the portion of boiler shells was received in London one of the fractured plates was separated from the other plates by carefully drilling out the rivets connecting them, and several strips were sawn cold out of the failing plate for testing purposes from the position shown in Fig. 3. Of these strips two each of 1 inch, 1½ inch and 2 inches width respectively were tested by Professor Kennedy, of University College, for tensile strength and elongation, with the results shown in Table IV., Specimens *B*, *C*, *D*, *E*, *F*, and *G*. The results seemed to be everything that could be desired so far as tenacity and elongation are concerned, *but the fractures appeared to be altogether different from those usual with good steel*, the distinct signs of lamination, the peculiar colour, and the crystallization being entirely new features.

Other strips about four inches wide (specimens *a*, *b*, *c*, and *d* in Fig. 3) were taken and subjected to bending tests. They were each found to be extremely brittle in proximity to the rivet holes, breaking across at the holes with one blow from the hammer, while but a short distance from the holes the strips bent cold to the same curvature as would be expected in ordinarily good steel; and on one of the strips being raised to a white heat and allowed to cool, it was bent nearly close without any signs of fracture.

As already stated, the holes in the original boiler shell had been punched and then rimed out slightly to make them fair, and the plates afterwards annealed. As so small an amount was rimed out from them, it would happen that in cases where the holes were unfair at first, the whole of the riming would be taken off one side of the hole, leaving the other side in the same condition as when punched. This is seen in several of the holes from which the rivets have been carefully removed, but as the plates were annealed after punching, previous experience would warrant the supposition that all injury from punching would be thereby removed.

In order to ascertain the effect of punching on the material, several holes were punched in these strips, and without exception it was found that the strips immediately became as brittle as the material in the vicinity of the original holes in the boiler, one blow being in every case sufficient to break them across the breadth of 4 inches, and no perceptible bending being produced before fracture. Pieces were then taken and holes punched therein; one piece was annealed after punching, in another the holes were rimed out ⅛ inch larger in diameter than the large side of the punched holes, and in a third piece the holes were drilled. In each case these samples bent to right angles across the holes without fracture. Similar pieces were prepared from steel made by the Steel Company of Scotland, the Landore Siemens Steel Company, and the Parkhead Steel Company, but in these cases the punching seemed scarcely to affect the bending capabilities of the material, the strips with punched holes bending to the same extent across the holes as the unpunched strips.

These experiments were afterwards corroborated by cutting off parts of the original joint of the plate from which the rivets had been drilled out, and striking each piece light blows with a hammer, which broke them easily into small pieces, but on the material from the same locality being annealed it was found to bend almost double even across the holes (*vide* Fig. 3, specimens *e* and *f*). A portion

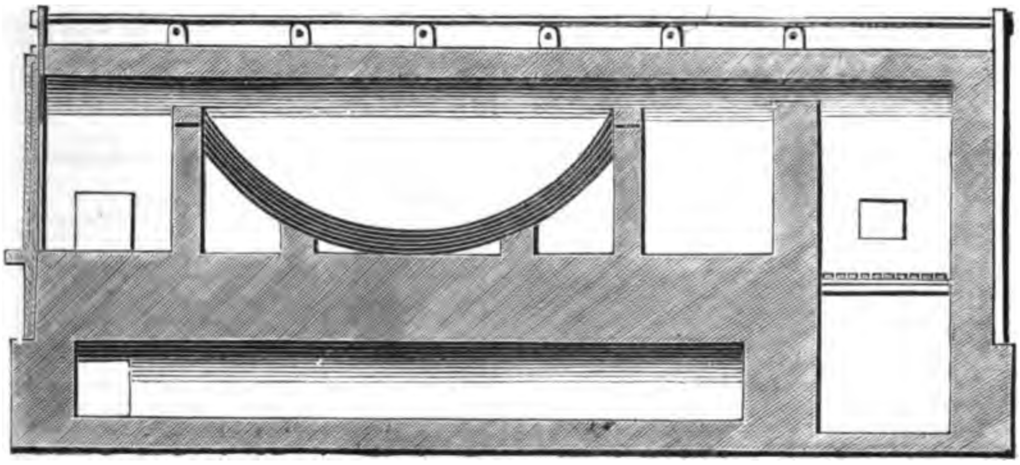
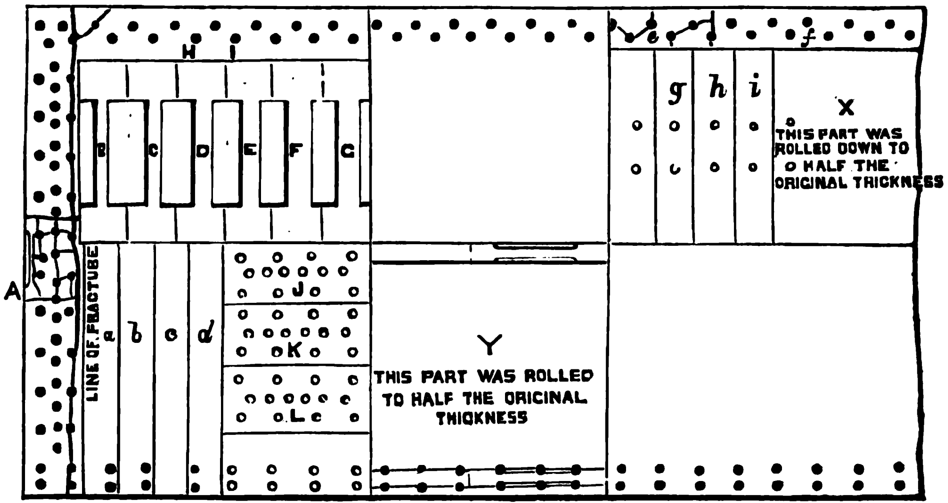


FIG. 1



H
I
B
C
D
E
F
G
e
f
g
h
i
X
THIS PART WAS ROLLED DOWN TO HALF THE ORIGINAL TRICKNESS
A
LINE OF FRACTUBE
a
b
c
d
J
K
L
Y
THIS PART WAS ROLLED TO HALF THE ORICINAL THIOKNESS

FIG. 3

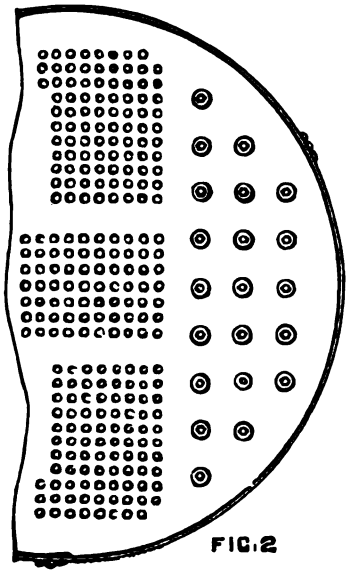


FIG. 2

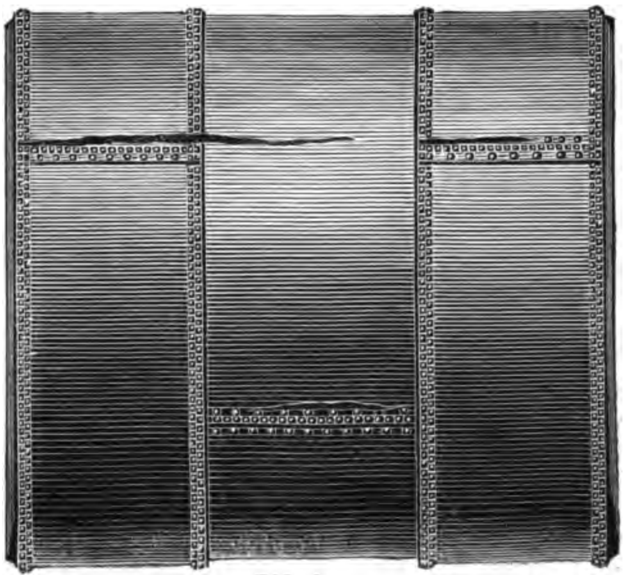


FIG. 4

TABLE B. — CHECK TESTS MADE BY MESSRS. J. ELDER & CO., ON RECEIPT OF THE PLATES.

Besides these Tensile Tests, a number of strips were cut and bent cold to corroborate Test in Table I., with satisfactory Results.

	Test Marked.	Direction of Rolling.	Dimension of Sample.			Strain of Section in Tons.	Strain per Square Inch in Tons.	Elongation in 8 Inches.	Per Centage of Elongation in 8 Inches.
			Breadth.	Thickness.	Area.				
Boiler No. 1 ...	1 A	**Crossways**	.96	·7	·672	18·0	26·78	2·08	26
	1 B	Ditto	·99	·71	·703	19·0	27·02	2·01	25
	1 C	Lengthways	·965	·705	·68	18·4	27·05	2·01	25
	1 D	Ditto	·965	·71	·685	18·85	27·5	1·88	23·5
Boiler No. 2 ..	2 A	Crossways	·98	·52	·509	13·75	27·01	1·88	23·5
	2 B	Ditto	·98	·52	·509	13·6	26·719	1·87	23·5
	2 C	Lengthways	·98	·53	·519	13·9	26·78	2·0	25
	2 D	Ditto	·99	·53	·519	14·2	27·36	2·34	29·25
Boiler No. 3 ...	3 A	Crossways	·97	·54	·523	14·9	28·49	1·86	23·25
	3 B	Ditto	·98	·55	·539	15·3	28·39	2·0	25
	3 C	Lengthways	·98	·56	·548	15·5	28·28	1·95	24·4
	3 D	Ditto	·99	·56	·554	15·9	28·7	2·15	26·9
Boiler No. 4 ...	4 A	Crossways	·985	·695	·684	18·25	26·68	1·97	24·6
	4 B	Ditto	·985	·695	·684	18·45	26·97	2·2	27·5
	4 C	Lengthways	.99	·69	·683	18·1	26·5	2·29	28·3
	4 D	Ditto	·985	·69	·679	18·15	26·73	2·175	27·2
Boiler No. 5 ...	5 A	Crossways	·98	·54	·529	14·85	28·07	2·17	27·1
	5 B	Lengthways	·98	·54	·529	14·9	28·16	2·05	25·6
	G 1	...	·99	·48	·4752	15·0	31·56	1·78	22·2
	G 2	...	·99	·48	·4752	15·3	32·19	2·0	25·0
	G 3	...	·99	·47	·4653	15·2	32·66	1·86	23·2
	G 4	...	·99	·47	·4653	15·2	32·66	1·84	23·0
	1	...	·99	·49	·4851	15·3	31·53	1·75	21·9
	2	...	·99	·49	·4851	15·2	31·33	1·73	21·6
	3	...	·99	·49	·4851	15·3	31·53	1·73	21·6
	4	...	·99	·49	·4851	15·2	31·33	1·73	21·6

Tests marked "G" were heated and allowed to cool in ashes.

Table C.—Results of Analyses made by Six eminent Metallurgists on Samples of the Steel Plates which failed in the Boilers of the "Livadia," and of Analyses made on Samples of good Boiler Steel.

	"Livadia" Boiler Steel.						Good Workable Steel.			
	A	B	C	D	E	F	G	H	I	K
Carbon	·063	·077	·100	·120	·125	·127	·104	·140	·160	·165
Manganese	·543	·640	·432	·420	·662	·552	·290	·641	·304	·684
Sulphur...	·064	·092	·080	...	·073	·094	·064	·056	·048	·084
Phosphorus	·063	·064	·045	·063	·060	·050	·070	...	·055	·060
Silicon	·015	·046	·063	·028	·020	trace	trace	...	...	trace

Analysis of a Sample of Steel Plate received on the 2nd instant from Messrs. John Elder & Co., Fairfield, Govan.

	Per Cent.
Iron	99·116
Carbon, combined	·130
Carbon, Graphite	absent
Manganese	·600
Sulphur	·082
Phosphorus	·072
Silicon	mere trace
	100·00

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Analytical and Consulting Chemist.

City Analyst's Laboratory,
138, Bath Street, Glasgow,
4th June, 1880.

of the unpunched plate was also taken and holes punched in it of the same diameter and pitch as those in the boiler seam, and it behaved in a precisely similar manner (*vide* Fig. 3, specimen *J*). A piece of plate was annealed before the holes were punched; it was also nearly if not quite as brittle as the unannealed piece, and a further piece annealed after punching, was found to bend well (*vide* specimens *K* and *L*).

Table D.—Analysis made by an Eminent Metallurgist on a Sample of the Steel which Failed in the Boilers of the "Livadia."

Shavings about $\frac{1}{16}$ inch thick were taken off in successive layers through the thickness of the plate, and carefully analysed for Manganese, Carbon, Phosphorus, and Sulphur, with the following results:—

	Mangan.	Carbon.	Phosphor.	Sulphur.
	Per cent.	Per cent.	Per cent.	Per cent.
1st $\frac{1}{16}$ in. Cut.	·280	·100	·040	·054
2nd "	·230	·110	·054	·065
3rd "	·367	·120	·069	·080
4th "	·410	·150	·076	·131
5th "	·283	·160	·077	·097
6th "	·283	·180	·079	·123
7th "	·348	·160	·072	·066
8th "	·381	·190	·074	·105
9th "	·371	·200	·095	·177
10th "	·237	·180	·086	·118
11th "	·288	·180	·079	·098
12th "	·237	·160	·076	·090
13th "	·360	·110	·050	·052
14th "	·381	·090	·039	·018

Four strips were then cut diagonally between some of the rivet holes of the boiler as shown on Fig. 3; one of them broke into three pieces with a blow from a hammer whilst trying to straighten it, and a similar piece after being annealed bent nearly close without fracture. A third piece was planed parallel, the punch marks being removed, and on being subjected to tensile test it was found to have a tenacity of 29·25 tons per square inch, with an elongation of only 4·7 per cent. in 5 inches (*vide* Table E, specimen *H*). The want of elongation observable in this specimen, combined with the curvature after testing, indicated that the stress caused by punching was not entirely removed, and accordingly a fourth strip was planed smaller, the metal being planed off at least ⅛ inch from the edges of the holes. This piece showed a tensile strength of 30·58 tons per square inch with an extension of 16·8 per cent. in 5 inches (*vide* Table E, specimen *I*). The elongation in this piece was more satisfactory and the reduction of area was considerable, but this piece was also curved after testing, showing that even the comparatively large amount planed off did not entirely remove the metal affected by the punching. These experiments conclusively proved that the metal in the vicinity of the rivet holes was considerably injured, being rendered quite brittle, that annealing restored it, and that other steels of apparently the same chemical composition and standing the same mechanical tests were not so affected.

It being thus found that punching holes in the plates made them extremely brittle, some specimens were prepared to ascertain the effect of that operation on the tensile strength of the material. A piece of plate was punched with two rows of holes and then sawn into strips, each strip containing two holes. In one strip the holes were rimed out, another was annealed, and the third was plain punched. On being tested, the rimed specimen broke at a stress of 27·6 tons per square inch, with an elongation in 8 inches of 7·5 per cent.; the annealed specimen stood 26·6 tons per square inch and stretched 6 per cent. in the same length; and the plain punched piece broke short off with no extension under a strain of 18·4 tons per square inch (*vide* Table E, specimens *g*, *h*, *i*).

These experiments merely corroborate those already published by various authorities on the effect of punching, riming, and annealing steel plates made by either the Bessemer or the Siemens process, namely, that plates above ⅝ of an inch thick punched with the largest diameter of bolster as compared with the diameter of the punch, consistent with obtaining a fair hole, lose about 30 per cent. of their tenacity, while riming out the holes or annealing the plates after punching restores the material to its original strength.

A narrow strip was cut from the plate next to that previously experimented upon, from a part of the plate remote from any of the rivet holes, and it was found to be extremely brittle. The fracture of this piece presented a very peculiar appearance.

The outside sixteenth of an inch on one side presents mirror-like facets from one-eighth to one-quarter inch wide, the rest of the fracture being of a fine granular, crystalline, but striated appearance. This outer layer is very soft, being easily nicked or cut on the edges by a penknife, and, as will be observed from the analysis, it contains no carbon, while the layer immediately below this contained a little, the inside of the plate containing more. This fact may perhaps account for the difference between the several analyses.

It would thus appear probable that this part of the plate had lost some of its carbon by a process the inverse of cementation, either by being overheated at one corner while in the form of an ingot or slab, or by a similar overheating while being annealed.

In further confirmation of the foregoing analysis, I have the results of another series of experiments on a piece of these plates from a gentleman of high authority, who has taken the greatest interest in this investigation. He took a portion of the plates about eight inches long and four inches wide, and after having carefully removed all the rust from the outside by grinding, he had successive layers planed off from one side to the other. Each layer was one-sixteenth of an inch in thickness, and the layers were numbered in succession as they were planed off. The results, as will be seen from the accompanying table, are extraordinary.

I had intended to pursue the question of the possible absorption of gases on this steel, but I regret to say I have been as yet unable to make much progress in that direction. It is pretty clear, however, that there is a fruitful source of inquiry in this direction which I hope will yet be taken up and pursued by some one more capable of doing so than I can pretend to be.

All the other specimens that were tested for tension presented an entirely different appearance from those of steel that has worked well; some of the fractures were crystalline whilst in the same fracture other portions were silky, others were filled with distinct laminations and cracks, and the colour of the fractures was quite different from the beautiful dark grey so marked in specimens of good steel. The peculiar appearance of the specimens suggested the idea that the plates might have been produced by rolling them from a slightly spongy ingot, the vacuities or air cells in which had been closed up during the operation of hammering and rolling, but the sides not perfectly united. It was also suggested that the plates might not have had sufficient mechanical work upon them, either by being cast in flat ingots and rolled direct into plates, or by cogging the ingots down to the thickness of the slabs instead of hammering them. Accordingly a piece cut from the fractured plate was raised to a red heat and rolled to half its original thickness (Fig. 3, Specimen *X*). Strips were then cut from this ⅜-inch plate and punched with holes ½-inch diameter, being one-half the size of those in the ¾-inch plate. This extra work on the material seemed to raise its ductility appreciably, the strips being found to bend well after punching, several of them bending to right angles and only one of them breaking short off, while none of them showed such extraordinary signs of brittleness as were observable in the material when of the original thickness. Three pieces tested for tensile strength after rolling broke under a stress of 33 tons, 34·25 tons, and 32·3 tons per square inch respectively, with an elongation in 8 inches of 12 per cent., 11·25 per cent., and 17·5 per cent. respectively, the last-mentioned specimen being annealed (*vide* Table IV., Specimens *X*). It was also observed that the fractures in these specimens were fine and silky, and had no appearance of lamination or crystallization such as existed before the material received this additional rolling, while the colour was precisely the same as that of specimens of steel that has given no trouble in working. In fact, the extra work bestowed upon the plates seemed to render them satisfactory. In order to corroborate these results a second piece was rolled down to the same extent and subjected to similar treatment with the same results.

The extreme brittleness of these plates, after holes are punched in them, would thoroughly explain the failure of the boiler under hydraulic test, had the plates not been annealed after being punched; but seeing that they were so brittle at the joints when in the boiler and that they became perfectly ductile when re-annealed, it is evident that they could not have been properly annealed in the first instance, after punching. This raises the important question, whether it is possible to anneal very large plates so as to thoroughly set at rest any strains induced by punching or local heating, especially when the plates are bent, and are therefore liable to become more intensely heated in one part than in another; and it shows the advisability of drilling all holes in such plates, and so avoiding the necessity for annealing.

The conclusions arrived at from this investigation may be summarized as follows:—

I.—That there is nothing in the chemical analysis of the material, beyond the want of uniformity described, to account for its behaving in an anomalous manner, and that, so far as can be discovered, the raw material used seems to be of a suitable quality.

II.—That the material as first rolled into plates stood the tests required by the specification, and also those prescribed by Lloyd's Register, the Admiralty, and the Board of Trade, the tensile stress, the elongation, and the bending tests being quite satisfactory.

III.—That the tensile strength of the material was not reduced by punching to a greater extent than is usual with mild steel, but that the plates when punched—whether one hole in a strip or several holes along the edge of the plate—became *extremely brittle* for some distance from the holes.

IV.—That the appearance of the fractures, especially in those samples broken by tension, showed that the material had not had sufficient mechanical work bestowed upon it, a number of minute laminations, cracks, and longitudinal splittings being distinctly visible in the specimens; and this defect, together with punching, made the material entirely unfit for employment.

V.—That further working of the material, to the extent required to reduce its thickness to one half, appears to have nearly, or entirely, eliminated the cause of the brittleness.

VI.—That, in order to avoid the use of similar plates in future, the fractures of test pieces should be carefully observed, and should any of them present an unusual appearance, further bending tests should be made on strips having holes punched in them of a diameter about 1½ times the thickness of the plates.

Since completing the foregoing investigations, and arriving at the conclusions set forth—indeed, since the preparation in great part of this paper—it has been my duty, in company with my colleague, Mr. John, to inquire into another series of failures of plates, this time used for shipbuilding purposes. The material had been supplied to Messrs. W. Denny & Brothers, Dumbarton, by the West Cumberland Steel Company, Workington, and as some of the plates had fractured in a somewhat alarming manner, we were directed by the Committee of Lloyd's Register to investigate the subject.

We were shown a couple of these fractured plates at Messrs. Denny's yard, one being a bow plate, the other a plate from above the boss which cracked through the landing edge. We had a strip about 3¾ in. broad cut from the latter, the strip being in the rough, sheared on one edge and punched on the other. It was placed on an anvil, and when struck with a hammer broke off short. This plate was $\frac{19}{32}$ in. thick, and broke at a tensile strength between 31 and 32 tons per square inch, with an elongation varying from 20 to 25 per cent. Having broken this strip off short with a hammer in its rough state, we had its edges planed down to remove those portions injured by the punching and shearing, when it bent over to a radius of ⅞ of an inch without fracture. A ¾-inch hole was then punched in the same piece, and after this it broke again short off with a blow from the hammer.

It was evident from this that the material resembled in its defects the steel which failed in the *Livadia's* boilers. The specimens were sent to the Steel Works, and we discussed the matter there with Mr. Snelus, who most frankly admitted that the material was not such as it should be, or such as he would knowingly have sent out from his works.

We have no reason whatever to doubt that the material was made by the Siemens process, that the ingots were of a reasonable size, and that they were hammered down into slabs in the usual way. What the exact sizes of the ingots were, however, we could not ascertain, but we were assured that 12 inches was the minimum.

We tested another plate at the works that had been sent back cracked from Messrs. W. Denny Brothers' yard, and a couple of other plates which Mr. Snelus himself had rejected at the works. Two of these plates were $\frac{13}{16}$ in. thick, and had been made for boiler shell plates, and Messrs. Denny's ship plate was $\frac{11}{16}$ in. thick. We had shearings cut from these three plates, and in each case they broke off short when it was attempted to bend them cold with their sheared edges in the rough. These plates were all brittle, and it became a question whether they had become so in the process of rolling, either by being rolled too hot or too cold; or whether it arose from an insufficient amount of work having been put upon them. To test this it was arranged to cut the plates up into six equal parts each, and to roll them down in duplicate at three distinct heats. One set was rolled down at the ordinary temperature, another at nearly a white heat, and the other set at as low a temperature as it was safe to adopt without breaking the rolls.

TABLE E.

REPORT ON TESTS CONDUCTED BY PROFESSOR KENNEDY IN THE ENGINEERING LABORATORY, UNIVERSITY COLLEGE, ON SAMPLES OF STEEL CUT FROM THE BOILER PLATES OF THE IMPERIAL RUSSIAN YACHT, "LIVADIA."

<table>
<tr><th rowspan="2">Date.</th><th rowspan="2">U. C. L. Test No.</th><th colspan="3">DIMENSIONS.</th><th rowspan="2">Limit of Elasticity.</th><th rowspan="2">Breaking Load.</th><th rowspan="2">Per-centage of Extension.</th><th rowspan="2">Position in Plate (<i>see</i> Fig. 3).</th><th rowspan="2">REMARKS.</th></tr>
<tr><th>Breadth.</th><th>Thicknes .</th><th>Area.</th></tr>
<tr><td></td><td></td><td>In.</td><td>In.</td><td>Sq. In.</td><td>Tons. Sq. In.</td><td>Tons. Sq. In.</td><td></td><td></td><td></td></tr>
<tr><td>1880.
July 28th</td><td>469</td><td>0·672</td><td>0·667</td><td>0·448</td><td>17·9</td><td>29·4</td><td>19·8 in 3 in.</td><td><i>A</i></td><td>Uniform finely granular "cup" fracture, with silky lustre.</td></tr>
<tr><td>Sept. 2nd</td><td>485</td><td>0·997</td><td>0·741</td><td>0·742</td><td>17·48</td><td>29·48</td><td>21·6 in 8 in.*
26·5 in 6 in.</td><td><i>B</i></td><td>Fracture, about 5 per cent. crystalline, the rest silky. Lamination distinct with longitudinal splitting, and distinct appearance of defective weld.
(Scale removed before testing, one side only, by hammering and rough filing.)</td></tr>
<tr><td></td><td>486</td><td>1·000</td><td>0·742</td><td>0·742</td><td>18·2</td><td>29·75</td><td>20·2 in 8 in.*
23·0 in 6 in.</td><td><i>C</i></td><td>Fracture silky, slightly specked with crystal. Lamination quite distinct and traces of splitting.
(Scale removed as No. 485 before testing.)</td></tr>
<tr><td></td><td>487</td><td>1·499</td><td>0·659</td><td>0·988</td><td>18·15</td><td>29·82</td><td>19·5 in 8 in.</td><td><i>D</i></td><td>Fracture silky, specked with crystal. Lamination very distinct. A pale salmon-red colour is very distinctly noticeable over a part of the fracture, bnt only in one of the two broken ends.
(Planed all over one side to take out a flaw.)</td></tr>
<tr><td></td><td>488</td><td>1·497</td><td>0·742</td><td>1·111</td><td>15·43</td><td>29·86</td><td>18·9 in 8 in.*
22·0 in 6 in.</td><td><i>E</i></td><td>Fracture, about 75 per cent. crystalline, and very distinct lamination throughout.
(Scale removed as No. 485 before testing.)</td></tr>
<tr><td></td><td>489</td><td>1·994</td><td>0·655</td><td>1·308</td><td>16·93</td><td>29·79</td><td>23·9 in 8 in.*
28·2 in 6 in.</td><td><i>F</i></td><td>Fracture, about 20 per cent. crystalline, remainder silky. Lamination very distinct.
(Planed all over one side as No. 487.)</td></tr>
<tr><td></td><td>490</td><td>1 994</td><td>0·656</td><td>1·308</td><td>16·04</td><td>30·20</td><td>23·1 in 8 in.*
28·0 in 6 in.</td><td><i>G</i></td><td>Fracture, about 30 per cent. crystalline, remainder silky. Lamination very distinct.
(Planed all over one side as No. 487.)</td></tr>
<tr><td>Sept. 3rd</td><td>491</td><td>0·742</td><td>0·674</td><td>0·500</td><td>18·93</td><td>29·25</td><td>4·68 in 5 in.</td><td><i>H</i></td><td>This piece was of the form sketched in Fig. 3, cut obliquely across plate between rivet holes. It was machined at the sides to remove all injury or marks from rivet holes which reduced it to the dimensions given.
† Fracture quite square across, and entirely (and somewhat largely) crystalline.</td></tr>
<tr><td>Sept. 30th</td><td>523</td><td>0·773</td><td>0·500</td><td>0·386</td><td>18·88</td><td>30·58</td><td>16·8 in 5 in.</td><td><i>I</i></td><td>† Fracture granular and silky, lamination visible, and slight splitting. Specks of crystal just visible.
Specimen cut diagonally across lap of plate as No. 491 (<i>see</i> Fig. 2). Tested as received, machined all over.</td></tr>
<tr><td>Novr. 1st</td><td>557</td><td>1·245</td><td>0·361</td><td>0·449</td><td>20·38</td><td>33·01</td><td>11·9 in 8 in.</td><td><i>X</i></td><td>Scribed with centre line and cross lines ¼ in. apart before testing.
Fracture of the ordinary "stepped bevel" shape, showing nothing unusual except a very slight trace of longitudinal splitting.
The specimen was <i>not</i> annealed.</td></tr>
<tr><td>1881.
Feb. 14th</td><td>680</td><td>1·242</td><td>0·350</td><td>0·435</td><td>13·26</td><td>32·31</td><td>17·5 in 8 in.
29·5 in 2 in.</td><td><i>X</i></td><td><i>Annealed.</i>—Trace of glassy substance which looks black through microscope in fracture.</td></tr>
<tr><td></td><td>681</td><td>1·272</td><td>0·366</td><td>0·466</td><td>13·41</td><td>34·26</td><td>11·25 in 8 in.
27·5 in 2 in.</td><td><i>X</i></td><td><i>Not annealed.</i>
The specimens 557, 680 and 681 were cut from a plate which had been rolled down from ¾ in. to ⅜ in.</td></tr>
<tr><td colspan="10">THE FOLLOWING TESTS WERE CONDUCTED BY THE SOCIETY'S ENGINEER SURVEYOR AT WEST HARTLEPOOL.</td></tr>
<tr><td>1880.
Oct. 27th</td><td>...</td><td>3·75</td><td>·75</td><td>2·062</td><td>...</td><td>18·4</td><td>none in 8 in.</td><td><i>g</i></td><td>Two holes 1 in. diameter <i>punched</i> on centre line (<i>not annealed</i>).</td></tr>
<tr><td></td><td>...</td><td>3·75</td><td>·75</td><td>2·062</td><td>...</td><td>26·6</td><td>6·0 in 8 in.</td><td><i>h</i></td><td>Two holes 1 in. diameter <i>punched</i> on centre line (<i>annealed</i>).</td></tr>
<tr><td></td><td>...</td><td>3·75</td><td>·75</td><td>1·875</td><td>...</td><td>27·6</td><td>7·5 in 8 in.</td><td><i>i</i></td><td>Two holes 1⅛ in. diameter <i>drilled</i> on centre line (<i>not annealed</i>).</td></tr>
</table>

* NOTE.—As the specimens were made, the 8 in. ength was between shoulders, and included fillets of ⅜-in. radius at each end. The extensions on 6 in. are therefore given in addition.

† NOTE.—It was particularly noticeable that these two pieces pulled themselves into sinuous curves. This indicates to some extent how greatly the material must have been strained by the formation of the rivet holes.

We then cut strips from these reduced plates for testing, and the results may be briefly summed up as follows :—

The thick boiler plates $\frac{15}{16}$ in. which were rolled down to $\frac{5}{16}$ and $\frac{9}{16}$ were found to have become ductile, and the rough shearings were capable of performing good bending tests, whether rolled down at an ordinary heat at a very high temperature, or at a comparatively low temperature, near a black heat. The plates rolled down at the ordinary temperatures, it is true, stood the tests best, but it was evident that the theory that a slight variation in the temperature such as would be at all likely to occur during rolling in practice would not account for the remarkable behaviour of the steel we were investigating.

In the case of the plate returned from Messrs. W. Denny & Bros.' yard, the effect of the rolling down was not so marked, but this might be accounted for in some measure by the fact that the plate was only $\frac{11}{16}$ thick to start with, and consequently did not get so much extra work put upon it as the two $\frac{15}{16}$ plates did.

Further tests were made in duplicate, all tending to show that with more work on the plates they improved, and that this was the case in spite of great variations in the temperature during rolling. The experiments also showed that when the plates were so rolled down they did not break off short when it was attempted to bend them across punched holes. In fact they bent to a considerable angle before showing signs of fracture at the holes, which then opened gradually, instead of going suddenly right across. I regret to say that we have since heard of further failures of this material in the same yard.

How far the greater or less amount of work done on plates in reducing them from the ingots is accountable for the failures and peculiarities which have recently come to light is a question of the utmost moment, and it is one which to my mind should be thoroughly investigated. I am aware that Mr. Webb, of Crewe, laid it down some years ago that the ingot should be at least twenty times as thick as the plate to be produced from it, and he had doubtless sound reason and experience to guide him in his decision. Whether, however, an inch steel plate rolled from a 24 in. ingot would be in the same condition as a half-inch plate rolled from a 12 in. ingot, is a question I am by no means sure upon. In more than one case during a recent visit to a number of steel works I had the pleasure to hear manufacturers express their perfect readiness to incur considerable expense in experiments rather than leave this question in its present unsettled state. I hope that feeling will become general. The remarkable variation in the distribution of the carbon, phosphorus, and other constituent elements is a point that must also be accounted for, and its true significance ascertained. And I would further add that the testing should be of a more varied and elastic nature than at present. The appearance of the fractures should be carefully watched, and where any departures from the well-known silky fracture common to good mild steel appears, the plates should be subjected to further bending tests on strips in their rough sheared condition, with holes punched in them, and in any other way that hereafter may be shown to be efficacious in discovering untrustworthy material.

I may add that in the case of most of the experiments I have described I have had the advantage of check tests almost in duplicate, which Mr. Kirk, of Messrs. R. Napier & Sons, has been good enough to make, and I have been fortunate enough to secure further check tests in other directions, so that I hope I may say with confidence that the results I have the honour to lay before the meeting are by no means isolated and unrepresentative ones.

In conclusion I have to express my best thanks to Messrs. J. Elder & Co., Messrs. Cammel & Co., Dr. Siemens, Mr. T. Vickers, Messrs. W. Denny & Bros., Mr. Snelus, Professor Kennedy, and many others who have rendered me most cordial and ready assistance in these investigations, and I must express my hope that instead of tending to create a prejudice against mild steel for constructive purposes, the facts I have laid before the meeting will tend rather towards a further improvement in its quality, and towards the removal of one of its last drawbacks, viz., its occasional, and not yet sufficiently understood, liability to fracture in a capricious and unexpected manner, under certain circumstances, while under others, it is capable of being bent double cold, and showing remarkable signs of ductility.

Mr. Kirk said he had been asked by Mr. Parker to make some tests, and he had done so. The first thing which came out was that the plates would bear very little manipulation. A strip about a foot long, slightly bent, would not bear straightening cold by gentle pressure. It cracked at once; but when heated and forged into a bar $\frac{5}{8}$ in. square it was so much improved that the bar could be bent cold on itself, so he thought that the material was good but the manufacture bad. He then took some Siemens-Martin plates, and tried to spoil them; he could injure them, but not make them as bad as the *Livadia* plates. Annealing might improve or spoil plates according to how it was done. He showed a sample strip of the original metal bent cold on itself without crack. A second sample, equally good, had been left in a forge furnace for twelve hours, the damper being down, and the air excluded; the plate was uninjured. Two other samples, heated in much the same way, but with the doors open and dampers up, so that a current of air passed through the furnace, were spoiled. A good plate could not be improved by annealing.

Mr. Thorneycroft said that if they would look at the drawing of the annealing furnace—Fig. 1—they would see that the plates had been so stacked on each other that uniform heating was impossible. The more work was put into steel the better. He used large quantities of thin steel—$\frac{3}{16}$ in., and it was usually tougher and better than thicker plates.

Dr. Siemens said, as one that was interested in the production of steel, and named also by the author as having given some attention to the cause of this extraordinary failure of the material, he wished to make a few remarks. The behaviour of the material composing the boilers of the *Livadia* was so extraordinary, and the results so contradictory, that it was certainly of the greatest interest that they should have it sifted to the very bottom. When the defective condition of those plates was first discovered, Mr. Parker kindly sent him a specimen of a piece of plate broken off short by a hammer, and the analysis which he had made showed that the metal was certainly irregular in its composition, but it gave a certain percentage of an element which he did not see represented on the author's table displayed on the walls, and that was silicon. The specimen which he had given him contained, certainly, a very considerable portion of silicon. Another analysis by eminent chemists had given, he was aware, different results. They had shown no silica; but if they looked upon the interesting table that had been placed before them, he thought they had quite sufficient hints given them to account for this great difference in analysis. Then they had in the same plate the carbon differing in the proportion of at least 1 to 2 between the outside of the plate and the inside of the plate, and they had phosphorus, a substance which was not easily oxidised when combined with metal distributed in the same irregular manner, and the same with regard to sulphur. Now the question arose—how could that very great difference in those constituents have arisen in the metal? Was it that the metal itself that the ingot contained was not composed of the same metal? or was it metal imperfectly fused and imperfectly distributed in the ingot mould; or had the metal, when being rolled into plate, been subjected to treatment whereby its chemical nature had been so completely altered, as would appear from the table on the wall? He could hardly imagine that in the same ingot, although there might be differences of composition found between one portion of it and another, that that metal had not been properly melted; differences of such extraordinary magnitude as that could possibly never occur, and he was therefore forced to the conclusion that the metal had been greatly injured in the after-process to which it had been subjected. Mr. Kirk had brought before them a very interesting experiment, showing how steel of undoubted good quality, when heated injudiciously, and heated for a length of time in a furnace, contained a large excess of oxygen—could be what they called in the iron trade "burnt." It would be interesting if they could have seen another column there, only he admitted that it would have been very difficult to show it. Of the amount of oxygen absorbed in the metal, he thought it would have been found that the place near the surface had absorbed a very considerable amount of oxygen, which assisted in the making it the brittle unreliable substance which it became when it was expected to do its work. It was stated in that Paper that every precaution was taken that when the plates, after punching, showed defects, they were taken back to the works to be annealed. Now, he was disposed to take great objection to that precedure. Mild steel should bear any amount of rough work in the cold condition without receiving the least injury. If by punching mild steel they lost strength he considered that they had a clear proof that the material was not what should be used. So far from losing strength, the very act of punching increases the strength of that material. In fact, any treatment to which mild steel was subjected, stretching it or punching it, squeezing it in any one place so as to alter slightly its form, the effect was invariably an increase of strength, and not a slight increase of strength either. It was, therefore, a practice with which he had little sympathy, that of annealing plates after punching. He would venture to say the metal used, if it were punched without being annealed, and if it were proper metal, should not require it. If the holes were afterwards bored to make the edges smooth it might be desirable to give more elegant work, but for the mere sake of getting strength and getting reliable work he did not believe that it was necessary that punching alone should give them the full strength of the metal when the work was put together. Therefore what they should know in order to judge this question more fully was the exact mode in which the metal was treated after it had been made—what size ingots were cast, and were those ingots hammered before they were rolled? If they were re-heated, as they undoubtedly were, what kind of furnace was used? Were they allowed, perhaps, to remain, as sometimes happened, a night in the furnace? He had known of workmen, taking offence at something or other, throwing down their tools and leaving the metal a whole night in the furnace. If metal was treated in that way it must be looked upon with great suspicion. Then again, Mr. Thorneycroft had alluded to the processes of annealing, which were sometimes adopted. I think there is great danger in annealing steel plates; and it was only necessary if that steel plate has been treated in a forge fire, if it had been heated partially in order to bend it, then annealing was necessary to bring it up as a whole into a natural condition, but if the metal had been worked cold he believed it better after having annealed it. This annealing was not always done in a proper and judicious manner. If one plate could be put into a well-heated furnace, and taken up rapidly, the temper which is necessary in order to put the particles at rest towards one another, and then taken up and allowed slowly to cool, there would be probably no danger arising, but if plates were heated up in an annealing furnace and when to bring the heat down to the bottom-most plate, a strong fire was applied to the uppermost plate, it was but natural that those plates were put to great danger. But the probability was that some of them would be overheated and that others would be heated all round at the edges, and not be uniformly heated, and any such process of annealing must be fraught with danger to the material produced. With regard to the process used, it was stated that the plates alluded to were made at the Cumberland Works, and were undoubtedly made by the Siemens process. Now this statement had been received authentically, but he thought there must be some little mistake about it, inasmuch as those works had only lately put up one furnace according to his system, and he was told by Mr. Snelus the other day that it had not been properly put to work. Therefore there must be some mistake about the process, not that he wished to imply that this could not have happened with steel manufactured by one process as well as by another.

Mr. Pence said, as a member of the firm who built the *Livadia*, he might say that they wrote to the West Cumberland Steel Company with regard to the plates of which the *Livadia* was built, and they received the answer that part were made by the Bessemer and part by the Siemens process; but they had not received any distinct answer as to which plates were used. He concurred with Dr. Siemens that the responsibility of making bad steel must be thrown entirely on the steelmaker; but he could not agree, however, with Dr. Siemens in the idea that working mild steel improved it. In all their experience they had no such evidence, and it would need very strong evidence indeed to convince him of it. Regarding the peculiarities of this steel he could only confirm the remarks made by Mr. John. The plate shown there was a plate from the vessel, and it had been screwed up and was right in every way, and the morning after it was screwed up it cracked in the manner shown in the diagram. Previous to those mishaps they had used 10,000 tons of steel, and they had had no mishaps of this kind. With regard to the fact that when the thinner steel was rolled the better it worked, he might say that the first steel from the West Cumberland Iron Company was then steel about three-sixteenths and a quarter of an inch thick, and it was used on a river steamer, and it stood a collision in a way which was perfectly surprising, and this encourged them to hope that the thinner steel would be the best, but they had been disappointed. The tests should be very crucial, and they should not be diminished in their severity, but rather increased. These mishaps to the *Livadia* had not shaken his confidence in the material, and the owners of the *Livadia* had determined to build their ships in future of steel. If they looked around they found 1,100 steel boilers working under conditions of great strain, and without any serious mishap, and he thought that these mishaps, instead of lessening their confidence, would make them more and more firm in insisting that steelmakers should give them the best steel, and punish the producers of bad steel.

Mr. Denny said that as regarded his plates part had been made by the Siemens-Martin process and part by the Bessemer process. He could not say which had failed. He had come to the conclusion that it was incumbent on himself and shipbuilders generally not to give orders to firms who supplied defective plates. This was the only way to compel steel makers to supply a trustworthy material; and he for one would never consent to take a plate from a firm which supplied untrustworthy metal. The steel makers must look to themselves. Working mild steel did not improve it. The plate referred to by Mr. Parker had been cottered up, and next morning was found broken. Thin steel—$\frac{3}{16}$ in. from the Cumberland Company's work stood splendidly. This opened his eyes to the fact that thin steel behaved differently from thick steel. In future tests ought to be increased in severity.

Mr. Riley thought the last remark of Mr. Denny was undoubtedly a just one—viz., that whilst attention was called so strongly to this failure, it was right that attention should be directed to the 1,100 boilers and the 17,000 tons of boilers steel now in existence where there had been no such mishap. As to the effect of the quality of iron used in making steel, if the iron taken into the furnace had an excess of silicon in its composition, undoubtedly the steel resulting would not be what was expected, even if the silicon should not be found present to any large extent. In these omissions might be found some explanation of the peculiar behaviour of this plate.

Mr. West said that 20,000 tons of steel plates had passed through his hands, and with comparatively satisfactory results. There were no failures even with the high tension steels, whose adoption he had advocated last year. They would have to be content with punched holes for ships, and he was of opinion that punching did not injure good steel in one sense. He had also found that if a strip of Bessemer steel were bent at right angles, and then straightened, its tensile strength would be augmented. He feared that in the case of the *Livadia* the original tests had been perfunctory. As for annealing the plates after they had cracked, it was locking the stable door after the horse had been stolen. A 22 in. ingot was quite large enough to make a $\frac{7}{8}$ in. plate out of.

Mr. Samuda remarked that in ninety-nine cases out of a hundred they had only now and then found a plate which was incapable of passing the ordinary tests of working processes which they used, but in those very few cases they had found, until the plate would break under the blow of a hammer, that it had been entirely restored to its natural position of ductility when it was properly annealed. Therefore, under circumstances, there were advantages in regard to annealing, but he quite agreed with Dr. Siemens that, as a general rule, they never used the annealing at all. His experience of working had now reached over twenty years, and it had been of every description of manufactured steel, and though no doubt the process had not yet reached the same perfection as that which was got by the mild steel, which they were now getting by the Martin and Siemens process, in all these cases they had found that a good reliable steel was able to be obtained when a sufficient amount of care was taken in the selection of the thing originally, and the manufacture of the steel. He had not gone into the question of the steel used in the *Livadia's* boiler, but as a general rule it must have been totally different from that which they had seen from either the Landore Company or the Steel Company of Scotland, or from the great manufacturer of steel in Germany, Krupps; all of which they submitted, without any difference whatever, to the same tests, and, as a rule, they came up to the very highest requirements and the greatest reliability that they could have with any materials. And the result of this investigation by Lloyd's, and the general observations in the room must go to strengthen the conviction, that while it was absolutely important that no one should relax in the smallest degree from requiring the greatest amount of perfection in the steelmakers, they should not be content with anything short of very best quality, and they should not allow prices to interfere with their desire to obtain it.

Mr. Martell held that while steel was better than iron, it would be foolish to shut our eyes to the fact that mysterious failures do occur. There was a mystery about mild steel which there was not about iron. The size of the ingot had a great influence. One steel manufacturer had tried to roll plates out of steel slabs, and had entirely failed. Mr. Webb, of Crewe, a man of great experience, said he could not get a sound plate from an ignot less than 24 in. square. That was an important statement. He could not restrain the expression of his astonishment at Dr. Siemens' assertion that punching did not weaken steel; it was contrary to all experience. Steel makers must not delude themselves by testing planed and filed samples, but rough samples, showing how the metal was handled in the shipyard. Confidence had been shaken, and must be restored by the steel makers.

Sir Spencer Robinson said that he had not lost any confidence in the mild steel as the right material for shipbuilding. The steel supplied to them by the Steel Company of Scotland had never failed under any circumstances. In the shipbuilding establishment in Hull they built several ships of steel, and a great many steel boilers, and they had not had one single case of failure that Mr. John described. On the contrary, their success had been complete in every respect, and they had none of those accidents, or cracking, or going wrong that had been described, and their steel was supplied by the Steel Company of Scotland. They had tested it over and over again. He had made many experiments of punching steel plates, and had found a loss of strength in punching which was restored in most cases by annealing. He knew that shipbuilders had to deal with steel in such a way that they could not always do otherwise than treat it by punching—they could not always bore it out. The materials that the shipbuilders used, and what they had a right to ask for from the manufacturers of steel was a material that punching should not affect and should not weaken. It would be a great mistake, and he should be very sorry, if the opinion went uncontradicted, and as far as possible unproved, that the punching of steel was a diminution of strength and not always restored by annealing. There were differences of opinion on this subject, and probably in all the cases there were some differences of circumstances which made the observations not exactly parallel and not exactly reliable. What was wanted was greater pains in the manufacture of steel, and greater care in the rolling down of the steel plates, and when that had been done and the proper work of the steel had been had recurrence to, everybody would admit that in a short time there was no material in the world comparable to the mild steel which might be had in this country.

Mr. Cowper, President of the Mechanical Engineers, observed, that many of those plates were very thick, and on the diagram there were eleven plates, one on the top of the other. Now, if they could imagine a pile of plates, placed 11, 12, or 13 inches high, either the top plate must have had too much heat, or too much fire, or the other plates must not have been properly annealed. It was quite impossible to heat those plates thoroughly through. Some of them would get too much and others not enough. With regard to the quality he saw by the table, that the carbon was ·149, the phosphorus ·069, the sulphur ·091, and the silicon somewhere about ·03. With those three last qualities added to the ·149, he did not wonder at the brittleness, and that an annealing furnace would not set it right.

Mr. Whyte, Assistant Secretary to the Navy, said, in the experiments which had been made in the navy they had tried samples sheard and slotted to shape. Under direct tensile strain they had not found a difference in the strength of the section where it was obtained by punching the edges, but there was a difference indeed when it came to forge tests. Then it was really too much to expect at haphazard to be able to deliver blows upon a forge test sample. When they came to forge tests he thought they should have some guarantee that they had no very unfair strains, and that other parts were not thus suffering.

Mr. Laird said, in their experience in making steel ships, they had only one instance of plate cracking, and it was in heating a straight plate in the furnace to bend it to the required angle, and the day afterwards it was found fractured, as in the case of the *Livadia*. Therefore, he was inclined to think that the heating had in this instance a great deal to do with the failure of the steel.

Dr. Siemens did not wish to say whether plates should be punched only, or whether it would be better to clean out the holes, but what he said was that in taking a strip of mild steel, he referred, not to the somewhat harder steel in shipbuilding, but the milder character used for boilers; and if they punched a line of holes across a plate of this steel and subjected it to tensile strain, the total strain that a piece of metal would bear should be fully equal to the normal strength of that material multiplied in the remaining cross section, and he based that view, not upon a mere theoretical ground, but upon many experiments which he had seen made and tried. Mr. Pearce told them that the punching did not affect the strength of the material in mild steel. That was the material for boilers. That was contrary to all their experience, and they had been in the habit of making tests with the plates for all the boilers that they made. Then, as to the question of annealing, that also was contrary to all their experience, for they found if they did not anneal a plate, after having worked a portion of that plate, there was a liability to crack. In his experience in steel, which had extended over a great many years, he had upwards of a thousand plates cracked through the inadvertence of not annealing. In his opinion, in future, all boilers made of steel should be bored and not punched. The boilers that he was making now were all bored, and, in fact, he was sure that the whole of the steel boilers that his firm had made since the *Livadia's* failure had been bored. The failure on the part of the steel of the *Livadia's* boiler had not shaken any confidence in him a bit. He thought that in looking back to the number of failures in other materials, certainly for every plate of steel that had failed there had been twenty plates of iron. He thought that the larger manufacture of the ingot was made with metal not of the same quality, and that it was more likely to contain inferior as well as superior metal, and, not being properly worked, it would not amalgamate fairly.

In reply, Mr. John regretted that no representative of the makers of the steel plates which had failed was present. The plate which gave way at Mr. Denny's was Siemens-Martin steel; for he himself had heard Mr. Snelus say that for ten years he had made Bessemer plates without a failure, and the moment he began to make Siemens steel he got into a mess. Tests should be on rough, not on planed, plates. There was a great deal about steel yet to be learned. For example, although it was said that the *Livadia's* plates were bad because they were not worked enough, it was difficult to maintain that, in face of the fact that the little test ingot taken from the Bessemer ladle, the "baby" ingot gave admirable metal.

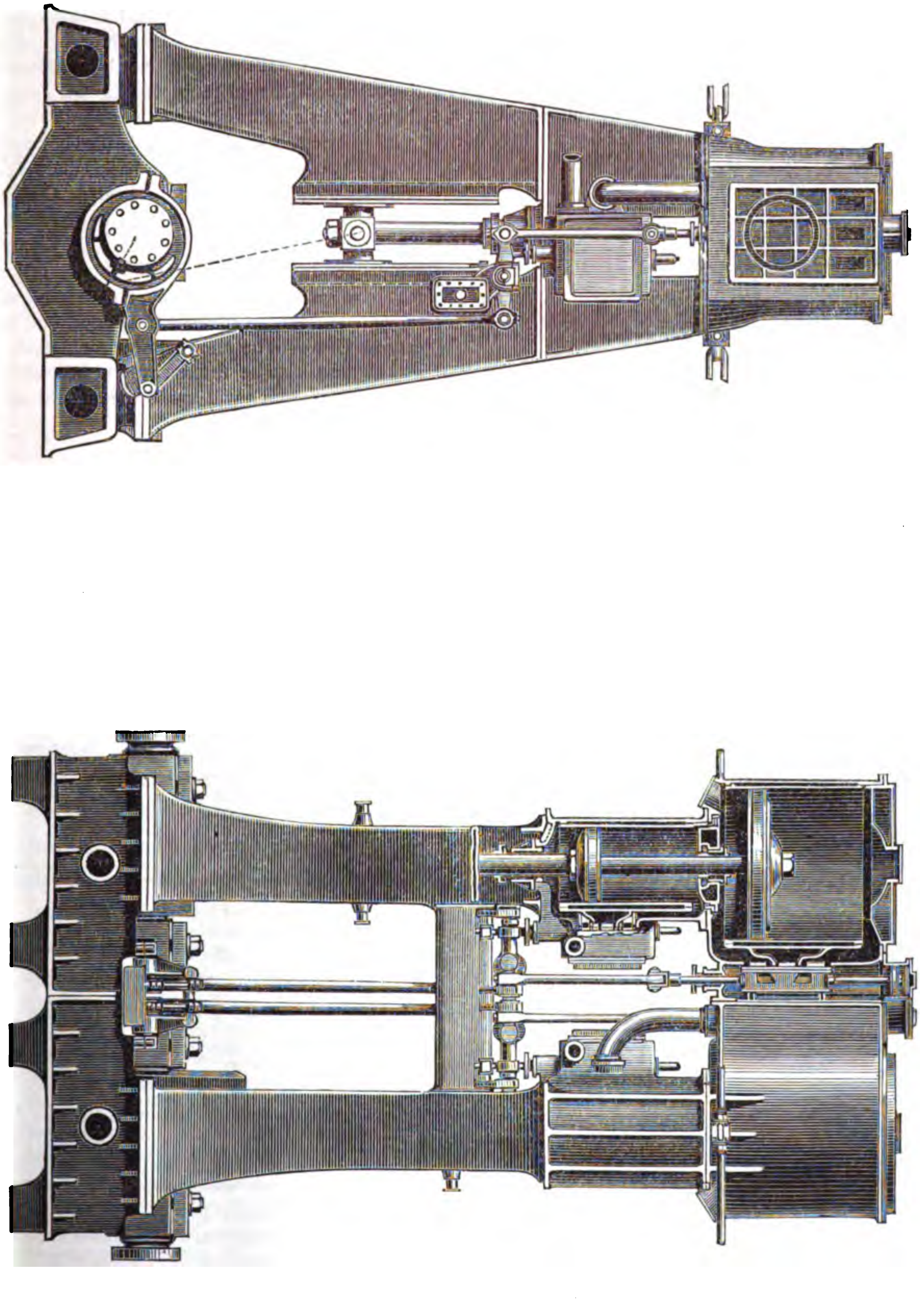
A vote of thanks was passed unanimously to Mr. Parker.

YOUNG'S COMPOUND MARINE ENGINE.

THIS design of a compound engine is a very neat one indeed, the side brackets or wings being so managed that they serve as a support to both high and low pressure cylinders, giving both in appearance and reality a great solidity to the engine. This is all the more important in the form of engine used, as the low pressure cylinder is above the smaller high pressure one, which would otherwise have caused the engine to look top-heavy, and in practice to be liable to a considerable degree of vibration. It will be seen from the sectional view that both cylinders are brought together end to end with only a single cover and stuffing box between. The advantages of this form of junction between the cylinders is obvious, in that it saves space, prevents radiation in some degree, and entirely obviates the drawing in of air through a gland into the low pressure cylinder when a vacuum is created. We are of opinion that this air leakage into the vacuum of the low pressure cylinder has a good deal to do with the imperfect vacuums so often obtained.

The chief practical difficulty, however, to such an arrangement, lies in the difficulty of getting at the intermediate cover and stuffing box between the two cylinders. This is fairly well attained in Mr. Young's engine, by the use of a man-hole in the projecting lower face of the low pressure cylinder. Through this the joint of the intermediate cover may be broken without taking off the low pressure piston, and in the same way the gland can be repacked. This gland may be screwed up as desired after packing by means of a worm wheel, from the outside of which the details are very clearly shown.

By breaking the joint of the two covers, both pistons may be drawn out still attached to the rod. This is a great point, as it is most desirable not to break the piston joint on the rod for temporary repairs. Nor is there any necessity to drain most of the cylinders, which is the case in some tandem engines, where an intermediate distance piece is used, or where the high pressure cylinder is on the top of the low.



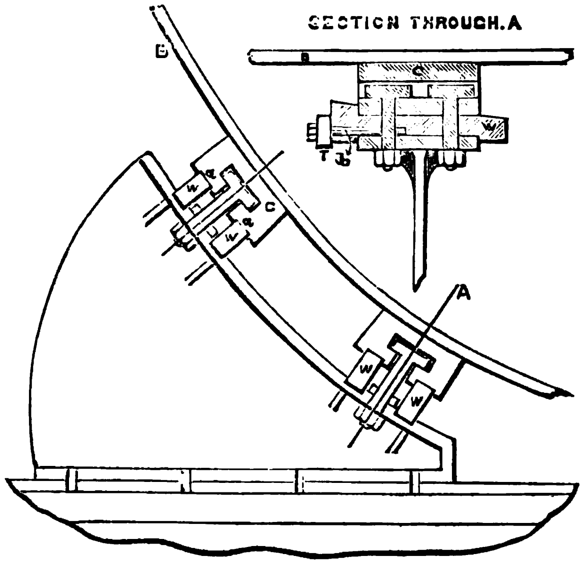
YOUNG'S COMPOUND MARINE ENGINE.

The valve gear, shown as adapted to the engines in our illustration, is that known as Marshall's gear, but although this gear works in very simply, it is by no means essential, and any usual form would work in just as well.

The very small size of the pressure slide valve may be noted as a good point, since it will relieve frictional resistance. The whole engine works out very lightly and compactly, containing great strength and power in a small space. The design is patented by the inventor, Mr. Henry S. Young, of 34, London Wall, E.C.

WHYTE'S REMOVEABLE BOILER BEARERS.

ANYTHING that will serve to prevent the deterioration of boiler shells, or to render such deterioration more readily observable will prove of great value to the users of steam boilers, either afloat or ashore. It is well known that the position of perhaps greatest deterioration or fitting is on the bearers or supports of the boiler. When these are fixtures, as they always are, as at present used, the corrosion has every opportunity to go on quietly and persistently. It is impossible to ascertain what injury is going forward, and it is equally impossible to scrape, clean, or paint that portion where it rests on the supports.



Mr. John Whyte, who is a practical sea-going engineer on board the Imperial Chinese gun-boat *Sin-tsing*, has invented the accompanying removable bearer, which to our minds will prove a great boon for the fixing of boilers afloat.

Referring to the illustration, B represents the boiler plate, C, a bearer or clock, with a T shot running through it, and into which two T headed bolts are placed. The boiler is supported on the two wedges W which are prevented from falling out by the guard piate I when the large end of the wedges are placed downwards. The bolt A has an eye on the inside end through which one of the T headed bolts passes ; a nut being screwed up on the outside of the plate preventing any possibility of the wedges slackening back.

It is obvious that when the T headed bolts are slacked back the wedges may be driven back, the weight being taken by other bearers, and the bearers C may be removed in succession and replaced in a very short time. The boiler shell may in such case be examined and scraped, and painted as desired. Any corrosion which may have set in would be seen at once, and as it generally arises from the accumulation or drip of water, the cause itself would be removed on examination. These bearers may also be fitted and finished before being sent on board, which will save some amount of chipping and fitting when in place.

ON THE EXPERIMENTS WITH THE PERKINS MACHINERY OF THE STEAM YACHT "ANTHRACITE."

From the Journal of the Franklin Institute.

By Chief-Engineer ISHERWOOD, United States Navy.

(*Continued from page* 7.)

TABLE CONTAINING THE DATA AND RESULTS OF THE EXPERIMENT MADE AT THE NEW YORK NAVY YARD ON THE MACHINERY OF THE STEAM YACHT "ANTHRACITE" BY A BOARD OF UNITED STATES NAVAL ENGINEERS—*Continued.*

HORSES-POWER.	Indicated horses-power developed in the 1st cylinder	20·4308
	Indicated horses-power developed in the 2nd cylinder	7·8290
	Indicated horses-power developed in the 3rd cylinder	39·4483
	Aggregate indicated horses-power developed in all the three cylinders	67·7081
	Net horses-power developed in the 1st cylinder	20·0628
	Net horses-power developed in the 2nd cylinder	6·3430
	Net horses-power developed in the 3rd cylinder	33·1150
	Aggregate net horses-power developed in all the three cylinders	59·5208
	Total horses-power developed in the 1st cylinder	28·8902
	Total horses-power developed in the 2nd cylinder	23·2490
	Total horses-power developed in the 3rd cylinder	28·0133
	Aggregate total horses-power developed in all three cylinders	80·1525
	Total horses-power developed by the expanded steam alone in the 1st cylinder ...	10·7400
	Total horses-power developed by the expanded steam alone in the 2nd cylinder ...	23·2490
	Total horses-power developed by the expanded steam alone in the 3rd cylinder ...	28·0133

Weight of Steam accounted for by the Indicator.	Pounds of steam present per hour in the 1st cylinder at the point of cutting off the steam, calculated from the pressure there... ...	633·5094
	Pounds of steam present per hour in the 1st cylinder at the end of the stroke of its piston, calculated from the pressure there...	609·6268
	Pounds of steam condensed per hour in the 1st cylinder to furnish the heat transmuted into the total horses-power developed in that cylinder by the expanded steam alone	30·8817
	Sum of the two immediately preceding quantities	640·5085
	Pounds of steam present per hour in the 2nd cylinder at the end of the stroke of its piston, calculated for the pressure there ...	808·3992
	Pounds of steam condensed per hour in the 1st and 2nd cylinders to furnish the heat transmuted into the total horses-power developed in those cylinders by the expanded steam alone	93·9542
	Sum of the two immediately preceding quantities	902·3534
	Pounds of steam present per hour in the 3rd cylinder at the end of the stroke of its piston, calculated for the pressure there ...	1150·7924
	Pounds of steam condensed per hour in the 1st, 2nd and 3rd cylinders to furnish the heat transmuted into the total horses-power developed in those cylinders by the expanded steam alone	167·0720
	Sum of the two immediately preceding quantities	1317·8644
Economic Results.	Pounds of coal consumed per hour per indicated horse-power	2·7115
	Pounds of coal consumed per hour per net horse-power	3·0844
	Pounds of coal consumed per hour per total horse-power	2·3319
	Pounds of combustible consumed per hour per indicated horse-power	2·2333
	Pounds of combustible consumed per hour per net horse-power	2·5405
	Pounds of combustible consumed per hour per total horse-power	1·9207
	Pounds of feed water consumed per hour per indicated horse-power	21·6387
	Pounds of feed water consumed per hour per net horse-power	24·6152
	Pounds of feed water consumed per hour per total horse-power	18·2791
	Fahrenheit units of heat consumed per hour per indicated horse-power	24265·69
	Fahrenheit units of heat consumed per hour per net horse-power	27603·52
	Fahrenheit units of heat consumed per hour per total horse-power	20498·22

(*To be continued.*)

[Owing to want of space we are compelled to let the remainder of this article stand over till next month.—Ed. M.E.]

The Phosphor Bronze Company, Limited, of Sumner Street, Southwark, London, S.E., have been awarded the highest prize, and also a Silver Medal for their exhibits of Phosphor Bronze specimens at the Melbourne Exhibition.

The trial of the improved Whitehead torpedo has been "productive of much success," and on the strength of this it has been decided to purchase four more for the Torpedo School, but the projectile is to be constructed of phosphor bronze, instead of steel.

The Admiralty overseeer at Sheffield reports that he is of opinion that the heat at which it is most dangerous to work steel is about 540 deg. Fah., and that the dangerous heat ranges over about 150 deg., viz., from 430 deg. to 580 deg. Fah., when it varies in colour from a light straw to a dark blue. He also considers that although the danger may not be so great throughout the whole of this range as it is at the first-named temperature, it is still, in his opinion, extremely unsafe to put any work whatever upon mild steel within these limits.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed.]

LAUNCHES.—English.

Poh Ann.—On March 29th Messrs. Wigham Richardson & Co., launched from the Neptune Shipyard, Low Walker, a steamer named the *Poh Ann*, being the second built by them to the order of Messrs. Guthrie & Co., of Singapore and London, for service in eastern seas. She will be engined by the builders, and although designed for fast passenger traffic, will carry a large cargo on an exceedingly small consumption of fuel. All the recent improvements in hull and machinery have been introduced into the vessel, and she fulfils every requirement of the Board of Trade and Lloyd's.

Royal Norman.—On March 30th there was launched from the yard of Mr. J. T. Eltringham, Stone Quay, South Shields, an iron tug steamer named the *Royal Norman*, of the following dimensions; —108 by 18·6 by 10 ft. She has been built to the order of Mr. J. M. Rennoldson, Engineer, &c., South Shields, for Messrs. Sharp Bros., of Sunderland and Cardiff. She will be fitted with engines of 80-horse power nominal, feathering wheels, steam windlass, &c., and all the latest improvements of the Board of Trade, under whose survey she has been built.

Aristides.—On March 31st Messrs. T. Royden & Sons, launched from their yard on the Mersey a steamer built of steel. Her carrying capacity will be 2,300 tons. As the vessel left the ways she was christened the *Aristides* by Miss Johnson. The steamer has been built to the order of Messrs. Layborn & Legge, Steamship Owners, of Liverpool, and will be fitted with engines on the compound surface-condensing principle, 700 indicated horse power, by Messrs. J. Jack & Co., and other approved modern appliances for economy and dispatch. Harfield's windlass, Harrison's steam steering gear, and Messrs. Cooke's & Mylchreest's patent split boss propeller, by which great economy in overhauling will be affected, have also been supplied, and the consequent loss and delay attending such work avoided. The vessel will receive the highest class at Lloyd's. She will be commanded by Captain De Silva. The steel for the vessel has been supplied by Messrs. W. S. & N. Caine, from the Landore Works, made by the Siemens-Martin process.

Akaba.—On March 31st Messrs. M. Pearse & Co., launched from their iron shipbuilding-yard at Stockton-on-Tees, an iron screw steamer of the following dimensions:—Length between perpendiculars, 300 ft.; extreme breadth, 36 ft.; depth of hold to top of floors, 25 ft. 6 in. This vessel is about 2,300 tons gross register, and will carry about 3,300 tons dead weight. She is built of the highest class granted at Lloyd's. She has a full poop aft, in which is fitted a saloon with passengers and officers' accommodation. This vessel is built off the three-decked rule, with two decks laid, both being of iron. She will be rigged as a three-masted schooner, and will carry double topsails on her foremast. She will be provided with engines on the direct-acting surface-condensing principal of 280-horse power nominal, by Messrs. Blair & Co., of Stockton, four steam winches and patent steam steering gear. She has double bottom for water-ballast, and all the most recent and improved appliances for expeditiously loading and discharging cargoes, and for ventilation and other sanitary purposes. This is the fourth vessel Messrs. M. Pearse and Co. have built for her Owners. As she left the ways she received the name of *Akaba.*

Juliet.—On March 31st Messrs. Raylton Dixon & Co. launched from the Cleveland Dockyard an iron steamer named the *Juliet*, built to the order of Messrs. C. T. Bowring & Co., of Liverpool, to be employed in the Red Cross Line of steamers trading from the Tyne to New York. She is very similar in dimensions to the *Titania* (s), which was built by them for the same firm about twelve months ago, being 285 ft. long, 36 ft. beam, and 24 ft. 6 in. depth of hold. Her cross tonnage is 2.070, and she will carry about 2,840 tons deadweight. As these vessels are largely employed in the important cattle trade which is springing up between New York and the Tyne, she has been specially fitted with an iron shelter deck, instead of the unsightly wooden erections which are generally employed for the purpose in this class of steamers, and has besides every convenience for carrying cattle, and also for the rapid loading and discharging of grain cargoes. She will be fitted with engines of 180-horse power by Messrs. T. Richardson & Sons, of Hartlepool, and will be ready for sea in a short space of time. On leaving the ways she was christened the *Juliet*, by Mrs. Olsen, wife of the manager of the yard. Only one month elapsed from the date of order to this vessel being entirely in frame.

Kelat.—On March 31st an iron sailing ship was launched from the building-yard of Messrs. Richardson, Duck & Co., South Stockton-on-Tees, of the following dimensions, viz. :—Length over all, 273 ft. 2 in.; length b.p., 255 ft.; breath, extreme, 41 ft.; depth in hold, 23 ft. 9 in.; tonnage, gross, about 1,875 tons; tonnage, nett, 1,800 tons. She is classed 100 A1 at Lloyd's, and has been built under special survey. The vessel has a full poop for the accommodation of first-class passengers, the captain, and officers; a topgallant forecastle for the crew; and a deck-house amidships for the petty officers, galley, &c. The ship has been built to the order of Thomas Bates & Sons, Liverpool. As the vessel was leaving the ways she was christened the *Kelat* by Mrs. Dixon, wife of Dr. Dixon, of Stockton-on-Tees.

Napier.—On March 30th there was launched from the yard of the Tyne Iron Shipbuilding Company, Willington-on-Tyne, a steamer for Mr. James Tait, Newcastle-on-Tyne. The following are her dimensions :—Length. 280 ft.; breadth, 36 ft.; depth, ;22½ ft. to top of water ballast tank; and 25½ ft. to bottom of water ballast tank; equal to about 24 feet depth ordinary build. She has a cellular double bottom. The vessel was built under special survey, and is classed 100 A 1 at Lloyd's. She is intended for the Indian and American trades, and specially adapted for a Government store ship. She will carry about 2.850 tons deadweight. The engines, which will be 180-h.p. nominal, are to be fitted in by the North-Eastern Engineering Company, Sunderland. The vessel was christened the *Napier* by Miss Isabella Wait, daughter of the owner.

Brenda.—On March 30th an iron screw steamer, built to the order of Mr. F. Erskind, of West Hartpool, was launched from Messrs. E. Withy & Co's shipyard at Hartlepool. Her dimensions are :—Length between perpendiculars, 257 ft. 6 in.; beam, 34 ft. 6 in.; depth of hold to Lloyd's floors, 19 ft. 6 in. She is classed 100 A 1 at Lloyd's, and will be fitted with engines of 150-horse power, by Messrs. Richardson & Sons, Middleton. She is built to carry 2,325 tons, and a special feature in the ship is that all decks, skylights, companion, &c., are constructed of iron. The vessel, which will be engaged in the Atlantic and Mediterranean Trades, is numbered 95 in the builders' books. As she left the ways she was christened the *Brenda*, by Mrs. Jabez Wood, of Hartlepool.

Strabo.—On April 2nd, this steamer, of 1,900 tons gross register, was launched at the yard of the Barrow Shipbuilding Company. She is meant for Oriental traffic. She is 290 ft. between perpendiculars, 35 ft. beam, depth of hold 24 ft. The engines are direct and compound, the cylinders being 26 and 60 ins. respectively; indicated horse-power 1,000. She is brigantine rig, and is owned by Messrs. Lamport & Holt, of Liverpool.

Merannio.—On April 2nd, Messrs. Wm. Grey & Co., West Hartlepool, launched from the shipbuilding-yard an iron screw steamer, measuring 216 ft. in length, 31 ft. breadth of beam, and 15 ft. 2 ins. depth of hold, intended for the Baltic and Mediterranean trades. The vessel is to be engined by Messrs. Blair & Co. (Limited), of Stockton, of 100-horse power, and is to be fitted with every modern improvement. This steamer, which is expected to carry over 1,200 tons deadweight, will be under the management of Messrs. Gledhill & Dishart, Leith. On leaving the ways she was named *Merannio*, by Miss Florence Gertrude Hunter, of Pendleton, Manchester.

Grangefell.—On April 2nd there was launched from the shipyard of Messrs. R. & J. Evans & Co., Liverpool, an iron screw steamer for the firm of Messrs. Hume, Smith, & Co., Liverpool. On leaving the ways she was christened the *Grangefell*, by Mrs. Smith. The steamer is intended for the conveyance of iron ore coastwise and pig iron and rails in transit, and is provided with all the most recent appliances and arrangements for the ready discharging and working of heavy cargoes. Messrs. David Rollo & Son, of Fulton Engine Works, are supplying the machinery; the engines are compound surface-condensing, and are constructed so as to economize fuel.

Perseverauce.—On April 2nd, Messrs. Short Bros launched at Pallion, Sunderland, the steamer *Perseverance*, built to the order of Messrs. Freear & Dix, Sunderland, who intend her for trading purposes in the Baltic, White Sea, and Lower Mediterranean. Her length over all is 225 ft., between perpendiculars, 220 ft.; extreme breadth, 32 ft. 6 in.; and depth of hold, 16 ft. Her gross register tonnage is 1,100, and deadweight cargo capacity about 1,450 tons. Half-poop to bridge, with full topgallant forecastle. Her classification is the highest in Liverpool Registry, and she is fitted with engines of 110-horse power by Mr. John Dickinson, of Palmer's Hill Engine Works. She has three large hatches, with horizontal steam winches to each, by Mr. Crawford, of Bonner's Field, and also patent steering gear, Harfield's patent windlasses, and all the latest improvements connected with merchant Shipping. She was christened by Mrs. Dix.

Baron Ardrossan.—On April 14 a vessel was launched from the Whitehall Iron Shipbuilding-yard, Whitby, of which Messrs. Turnbull & Son are the proprietors. The vessel, which was christened *Baron Ardrossan* by Miss Hogarth, daughter of the owner, is of the following dimensions :—Length, 243 ft. 6 in.; breadth, 34 ft.; depth of hold, 17 ft. 9 in.; engines, 130-horse power, by Blair & Co., of Stockton, and patent windlass by Emerson, Walker & Co., London. The deadweight carrying capacity is about 1,750 tons. The vessel has been built to the order of Mr. Hugh Hogarth, Ardrossan.

Arica.—On April 14th a screw steamer, built to the order of the Pacific Steam Navigation Company, and intended to be employed in their West Coast Service, was launched from Messrs. Laird Brothers' works at Birkenhead, and was christened the *Arica* by Miss Nelson, daughter of Mr. P. Nelson, one of the directors of the company. The *Arica* is constructed entirely of Siemens-Martin steel, and is of the following dimensions :—Length, 300 ft.; beam, 36 ft.; depth to main deck, 22 ft.; tonnage, builders' measurement, 1,920 tons. She will be fitted with a set of direct acting inverted compound engines to work at 90 lbs. pressure, and develop 1,100 indicated horse power, which, with their boilers (also of steel), are of Messrs. Lairds' manufacture, and ready to go on board. The *Arica*, like the majority of the company's coast steamers, is constructed with an awning deck, and in houses on that deck there will be accommodation for a moderate number of passengers, as also for captain and officers, but she has been designed principally for cargo and cattle traffic. She will be rigged as a schooner with three steel pole masts, and fitted with steam steering gear and all the latest improvements. The *Arica* is the fifth vessel launched by Messrs. Laird within four months, and she will shortly be followed by the *Ecuador*, a sister ship, for the same company.

Surrey.—On April 16th Messrs. W. Gray & Co., of West Hartlepool, launched from their yard a screw steamer of the following dimensions :—Length, 360 ft.; breadth, 40 ft.; and depth, 24 ft. 6in., and 31 ft. 3 in. to spar deck. The vessel has been built to the order of the Atlantic Transport Company (Limited), and will be under the management of Messrs. Hooper & Williams, London. She is intended for the cattle trade between London and Boston. Special attention has been given to ventilation. The cattle fittings are all permanent, and made entirely of iron, and are for 550 cattle and 1,000 sheep. The new steamer is to be engined by Messrs. Blair & Co. (Limited), Stockton, 220-horse power, and furnished with every modern appliance and improvement, and she will carry 3,800 tons deadweight; to be commanded by Captain Bacon On leaving the ways the vessel was christened the *Surrey* by Mrs. John Hooper, wife of the managing owner.

Kingsley.—On April 16th Messrs. Thomas and William Smith launched from their yard at North Shields a screw steamer, built to the order of Messrs. Edward Eccles & Co. of Newcastle. This vessel (which was named the *Kingsley*) is 180 ft. long, 30 ft. beam, and 13 ft. 6 in. deep from top floors. She has been built under special survey for class 100 A 1 at Lloyd's. Her carrying capacity is about 800 tons. She is destined principally for the coal trade to small coasting ports.

Sportsman.—On April 16th a screw steamer, built to the order of Mr. Wm. J. Jobling, Newcastle, was launched from Messrs. Palmer & Co.'s yard at Jarrow. The vessel measures 290 ft. over all, her beam is 36 ft., and her depth is 23 ft. Her carrying capacity deadweight will be 3,000 tons. Her engines, which will be built at Jarrow, will be of 200-horse power nominal. She will class 100 A 2 at Lloyd's. She is intended for the Indian and Atlantic trades. She was christened the *Sportsman*.

Crawshaw Bailey.—On April 25th Messrs. Edward Finch & Co. (Limited), of Chepstow, launched from their yard an iron screw steamer, built to the order of Captain E. J. Harley, Milton Villa, Penarth. Her dimensions are :—Length, 110 ft.; breadth, 19 ft.; depth of hold, 10 ft. 2 in.; classed 100 A 1 at Lloyd's, to carry 230 tons deadweight. She has full poop, bridge, topgallant forecastle, and is fitted with steam winch, patent windlass, &c.; engines compound, surface condensing, inverted, vertical direct-acting, of 45 nominal horse-power, to work at a boiler pressure of 85 lbs. per square inch. As she left the ways she was christened the *Crawshaw Bailey* by Miss Harley. There were also present Captain and Mrs. Harley. Mr. Aisbitt (designer of the ship), Mount Stuart Square, Cardiff, and Miss Aisbitt. The builders were represented by Mr. Rowe, the managing director of the Company.

Barnsley.—On April 27th there was successfully launched from the shipbuilding-yard of Messrs. Robert Thompson & Sons, Southwick, an iron screw steamer, built to the order of Messrs. Henry Briggs, Son & Co., Hull, of the following dimensions, viz. 284 ft. long by 35 ft. broad and 24¼ ft. depth of hold, having been constructed on the three deck rule, under Lloyd's special survey, to class 100 A 1 She has a short full poop with cabin for captain, and spare berths; accommodation in bridge-house amidships for officers and engineers, and for firemen and crew in top-gallant forecastle, and is being fitted throughout with all the latest improvements, including ample water ballast fore and aft, four steam winches, and donkey boiler by Messrs. Roger & Co.; crane on forecastle for lifting anchors, &c.; patent steam steering apparatus amidships; also patent screw gear aft, Harfield's patent windlass, &c., &c. Her engines, which are on the inverted direct-acting compound surface condensing principle, and of 200-horse power, are by George Clark, Esq., Southwick. As the vessel left the ways she was gracefully christened the *Barnsley* by Miss Reed, of Hull.

LAUNCHES.—SCOTCH.

Oaks.—On March 30th, Messrs. Thomas B. Seath & Co. launched from their shipbuilding-yard at Rutherglen a steam yacht of 132 tons burthen, specially built for the use of Mr. T B. Seath, and designed with a view to the attainment of great speed. Her dimensions are as follows:—Length, 140 ft.; breadth of beam, 14 ft.; depth, 8½ ft. She is fitted with engines of 14 and 20 inch cylinders, which will work at a pressure of 100 lbs. steam. On leaving the ways she was named the *Oaks* by Miss Jessie Steel, daughter of Provost Steel, Ayr.

Lido.—On March 31st Messrs. Murdoch & Murray, Port Glasgow, launched the *Lido*, a steel screw steamer about 1,200 tons register, with cellular double-bottom water-ballast fore and aft, and classed 100 A 1 at Lloyd's. She has been built for Messrs. Raeburn & Verel, Glasgow, under the superintendence of Messrs. M'Nicoll & Smith, Glasgow, and will be fitted with engines of 120-horse power nominal, by Messrs. Kincaid, Donald & Co., Greenock.

Imerina.—On April 1st the Campbeltown Shipbuilding Company launched from their building.yard, at Trench Point, a screw steamer of 350 tons burthen, the dimensions of which are 135 ft. by 21 ft. 3 in. by 10 ft. 9 in. She has been built to the highest class of Lloyd's, under special survey, and will take her station in the East, where she will carry deadweight cargo and cattle, accommodation being also made for passengers. As the vessel left the ways she was named the *Imerina* by Miss Alice M'Fadyen, of Messrs. Kincaid, Donald & Co., of Greenock, with compound surface condensing engines, and will be fitted with all the latest improvements.

Falcon.—On April 1st Messrs. Dobson & Charles launched from their yard, at Grangemouth, an iron screw yacht of 60 tons, to the order of Messrs. John Englis & Co., naval architects, Glasgow. Dimensions:—82 ft. by 12 ft. by 8 ft. The engines are compound surface-condensing of 100-horse power effective, by Messrs. Scott Brothers, Crookston Street, Glasgow. The yacht was named *Falcon* as she left the ways.

Elbe.—On April 2nd Messrs. John Elder & Co. launched from their shipbuilding yard at Fairfield, Glasgow, a fine iron screw steamer, named the *Elbe*, for the North German Lloyd's Company of Bremen—the first vessel yet built at Fairfield for the large fleet of that eminent company. This steamer, which is intended for the Bremen and New York trade, is of the following dimensions:—Length, 440 ft.; breadth, 45 ft.; depth, 36 ft. 6 in. She is classed in the highest grade of the Bureau Veritas, with several extras over the requirements of that registry, such as iron lower and orlop decks, and additional water-tight bulkheads. Teak is employed for the upper deck, while the deck-houses and deckwork are partly formed of teak and partly of iron. In order to protect the vessel from the heavy Atlantic seas, strongly constructed iron turtle-back decks are placed at both ends of the ship. Occupying the central part of the upper deck there are the houses for the officers, firemen, &c., together with the galleys, smoking rooms, and entrances to the first and second saloons, &c.; and extending over the whole length of these deck-houses there is a most spacious promenade deck, about 180 ft. long and the whole width of the vessel, and entirely reserved for the use of the first-class passengers. In addition to the accommodation for the ship's officers and crew—numbering 170—the *Elbe* will carry 120 first-class, 120 second-class, and 1,000 steerage passengers. The first and second saloon passengers will be berthed on the main deck, and the steerage passengers on the lower deck. The chief saloon, which is placed forward of the engines and boilers, will be a very handsome and comfortable apartment, being about 40 ft. square, beautifully lighted from a cupola from the promenade deck, and furnished and fitted up in the most luxurious manner. The sleeping cabins for the first-class passengers are situated before and abaft the saloon, while the smoking-room is on the upper deck and the ladies' saloon on the promenade deck. The accommodation for the second-class passengers is placed abaft the first-class, and will be fitted up in a plain though comfortable manner. Rigged with four pole masts of iron, and with yards on the fore and main masts, the *Elbe* will be provided with steam windlass, steam and hand steering gear, steam winches, steam hold pumps, steam "Navy" pumps, fresh-water condenser, and, in fact, all modern appliances to insure the safety of the vessel at sea, and to facilitate the working of cargo. She will be propelled by compound engines of the inverted cylinder type supplied by the builders, having two low-pressure cylinders of 85 in. diameter, and one high-pressure cylinder of 60 in. diameter, by 5 ft. stroke, and working up to 75 ℔. pressure. Steam is to be supplied by four double-ended boilers, with six furnaces in each; and it is fully expected that the engines will develop 5,400 indicated horse power. As the vessel left the ways she was named the *Elbe* by Miss Cargill.

Innishowen.—On April 4th there was launched from the building yard of Messrs. Napier, Shanks & Bell, Yoker, a paddle-steamer of about 110 tons, for Messrs. M'Crea & M'Farlane, of Belfast and Londonderry, intended for passenger and goods traffic on Lough Swilly. The Innishowen, as the new steamer is named, while designed to develop the increasing trade of the district, will be specially fitted for the accommodation of passengers. The The vessel was named by Miss Duncan, Hillhead. The machinery is being fitted on board by Messrs. Ross & Duncan, Glasgow, and the steamer is expected to be placed on her station next month.

May.—On April 4th, Messrs. Robert Steele & Co., Shipbuilders, Cartsdyke, Greenock, launched from their yard a 40-ton racing cutter, which was named the *May*. Her dimensions are:—Length of load-line, 63 ft. 7 in.; and breadth, 12 ft. The cutter is composite, with steel frame, teak topsides, and elm bottom, copper and metal fastened throughout. She will have the highest class at Lloyd's.

Horsa.—On April 6th Messrs. Lobnitz & Co. launched from their yard at Renfrew an iron screw steamer 205 ft. by 27 feet by 21 feet, and immediately thereafter placed her in their tidal docks to receive her boilers and machinery. This vessel has been built to the order of Jydsk Engelske Dampskibs Selskab of Aarhuus, and has been specially designed for the cattle trade between Aarhuus and Newcastle. She has water ballast fitted in main hold, and in double bottom in the after hold, as well as tank compartments in the peaks of the vessel. The boilers and machinery which the same builders have constructed for this vessel are 165-horse power nominal, and will enable the vessel to maintain an easy service speed of 11 knots per hour. She will be commanded by Captain Bense. The ceremony of naming the vessel *Horsa* was performed by Mrs. John Jack, wife of one of the partners of the builders' firm.

Serena.—On April 11th there was launched from the shipbuilding-yard of Messrs. Robert Napier & Sons, Glasgow, a steel screw steamer of 3,000 tons, for the Pacific Steam Navigation Company, Liverpool. This is the fourth vessel of this type built for the company by Messrs. Napier. She is designed for the Pacific trade, and fitted with the most modern appliances for the accommodation of passengers and the efficient working of the cargo, a new feature in the vessel being the hydraulic winches and windlass, which have been fitted on board. As the vessel left the ways, she was named the *Serena* by Miss Hardy, and was afterwards towed to the harbour, where she will receive her engines, of 2,500 indicated horse-power, which have been constructed by the builders.

Catania.—On April 13th Messrs. Alex. Stephen & Sons, launched from their building yard at Linthouse, Glasgow, an iron screw-steamer, of about 2,300 tons, built under special survey to the highest class in Lloyd's. This is the latest addition to the fleet of Messrs. Rob. M. Sloman & Co., Hamburg, and is the eleventh vessel built by the Messrs. Stephen for that firm. She is of the most modern type, embracing all recent improvements, such as a double bottom throughout for water ballast on bracket principle, Emerson Walker & Co.'s, patent windlass, steam steering gear, steam winches, and all the best appliances for working cargo, &c. The accommodation for captain and officers is in houses amidships, and, in connection with same, there is accommodation for a limited number of first-class passengers. The engines and boilers, also made by the Messers. Stephen, were fitted on board before launching. The cylinders are 35 in. and 65 in. diameter by 42 in. stroke, supplied with steam from two very ample boilers, suitable for 80 lbs. pressure. The ship, which has a full poop and topgallant forecastle, is rigged as a two-masted schooner. She was named the *Catanea* by Miss Lucy Aikman, Middlefield, Glasgow. One of the specialties in the vessel is a hold for carrying meat, refrigerated by an apparatus supplied by Messrs. M'Ilwraith, M'Eacharn & Co., London.

North Sea.—On April 13th there was launched at Dundee, by Messrs. Alex, Stephen & Sons, a screw steamer, named the *North Sea*, built to the order of the Dundee, Perth, & London Shipping Company. Her dimensions are as follows:—Length, 230 ft.; breadth, 30½ ft.; and depth of hold, 17 ft. 2 in. She is 1,100 tons gross, and will be fitted up by Pearce Bros., Dundee, with engines 120-horse power. The *North Sea* is a cargo boat, intended for the Baltic and White Sea Trades, and will be commanded by Captain Booth, formerly of the Scotia (s).

Routenburn.—On April 14th Messrs. R. Steele & Co. Greenock, launched from their yard a four-masted iron sailing ship of about 2,000 tons register, built to the order of Messrs. D. & R. Shankland, Greenock. She is 305 ft. in length over all; length of keel and forerake, 274 ft.; breadth 42 ft.; and depth of hold, 24 ft. The vessel has been built to the highest class in Lloyd's, and the latest improvements have been taken advantage of in her construction. The large vessel, as she left the ways, was named the *Routenburn* by Miss Bessie Shankland, daughter of one of the owners. The *Routenburn* is barque-rigged with jiggermast, and is to be employed in the East Indian trade. After the launch, she was towed into the Victoria Harbour, where she will be fitted out. Her maiden voyage will be to Calcutta.

Amitié.—On April 14th Messrs. H. M'Intyre & Co., launched from their shipbuilding-yard at Merksworth, Paisley, an iron screw steamer of 850 tons. The vessel, which was named the *Amitié*, has been built to the order of a French firm for their trade between France and Britain. She is built to the highest class at Lloyd's, under the superintendence of Captain Courpon, who is to command her; is fitted with water ballast in double bottom, all fore and aft, and all usual appliances for loading and discharging quickly. She will be fitted with a pair of compound-surface condensing engines by Messrs. Fleming & Ferguson, Phœnix Engine Works, Paisley.

Armenia.—On April 14th a screw steamer was launched from the shipbuilding-yard of Messrs. David and William Henderson, at Meadowside, on the Clyde. Her dimensions are 364 ft. in length, 38 feet in breath, and 28 ft. 6 in. in depth, her gross tonnage being 3,380. She will be fitted with compound engines, with cylinders of 33 and 66 in. diameter, and 5 ft. stroke. This vessel is a sister ship to the *Hispania* and *Roumania*, lately built in the same yard. She is fitted with Emerson, Walker & Co.'s Patent Direct Steam Capstan Windlass, and is intended for the Anchor Line service between Glasgow, Liverpool, and Kurrachee. As she passed from the stocks into the water the new vessel was named the *Armenia*.

Laja.—On April 16th Messrs. John Reid & Co. launched from their yard at Port Glasgow a steamer named the *Laja*, of the following dimensions:—Length, 320 ft.; breath of beam, 40 ft.; depth of hold, 23 ft.; and of 2,200 tons. The *Laja*, which has four decks, has been built for the South American Company of Steamers, Valparaiso, and is to trade on the West Coast of South America. There is accommodation on board for 100 first-class passengers. This vessel is fitted with Harrison's patent steam steering gear. Messrs. Rankin & Blackmore, Greenock, are to supply the engines, of 400-horse power, and after the launch the steamer was towed to Greenock.

LAUNCH—IRISH.

Mary Miller.—On April 14th a new three-masted schooner was launched from Mr. Rodger's shipyard, Carrickfergus. Her dimensions are:—Length 96 ft.; breadth of beam, 22 ft.; depth of hold, 9 ft. 8 in. Her register tonnage will be about 100, and her carrying capacity 210 tons. The ceremony of christening the new vessel was performed by Mrs. Lynn, who named her the *Mary Miller*. She has been built to the order of Messrs. James Fisher & Sons, of Barrow, and is a sister ship to the *Fanny Crossfield*, built some time ago by the same firm. She has been classed A 1 at Lloyd's for 12 years, and is intended for the iron ore trade.

TRIAL TRIPS

Romeo.—On March 31st the new mail steamer *Romeo*, the latest addition to the fleet of steamers belonging to Messrs. T. Wilson, Sons, & Co., of Hull, performed her trial trip, and the test which she underwent proved satisfactory in every respect. This vessel is specially constructed for carrying mails and passengers, and is adapted to convey 1,000 emigrants between decks, 20 second class passengers, and 40 saloon passengers. She is 275 ft. in length, 34½ ft. broad, and 20 ft. deep, her registered tonnage being 1,209, and gross tonnage 1,850. The engines are 300 nominal horse power combined surface condensing, the cylinders being 38 in. and 76 in. diameter respectively, by 48 in. stroke, and are supplied by steam of 80 lbs. pressure. The steam is generated in two double-ended cylindrical boilers of very large size, having six furnaces 42 in. each in diameter. They are manufactured of Siemens-Martin steel, supplied by the Steel Company of Scotland, and the size will admit the full power being maintained throughout the voyage. The engines are fitted with the latest improvements, and are controlled by powerful steam steering gear, which is arranged to propel the engines when the steamer is in port, and the machinery undergoing repairs. During the trip the engines ran at 62 revolutions (full boiler pressure of 80 lbs.) the vacuum being 27 in. and the indicated horse power 1,600. This speed was maintained all the way to the measured mile, along which a mean speed of 13 knots for four journeys—two each way—was obtained. The time taken in turning a complete circle was 5 minutes 30 seconds. Notwithstanding that the engines ran nearly all the day at the high speed stated they gave no trouble whatever, and did not necessitate the water service being put into use; and from the time of the start to the *Romeo's* return the supply of steam was ample. One of the most noticeable improvements is that the ship is to be lighted up with gas generated by a chemical process in the engine-room, and which was illuminated by this means during the trip.

Strathallan.—On March 31st, the screw steamer *Strathallan*, built by Messrs. Henry Murray & Co., Port Glasgow, was tried on the Clyde, and attained a speed of nearly 12 knots per hour in water ballast trim over the distance between the Lights and on the measured mile. Her engines, of 99-horse power nominal, were supplied by Mr. William Kemp for the owners, Messrs. James Hay & Sons.

Ranee.—On April 1st, the new screw steamer *Ranee*, built by Messrs. Ramage & Ferguson, Leith, for the Borneo Company (Limited), of London and Singapore, went out on her official trial with very satisfactory results, with over 300 tons dead weight on board, 75 lbs. pressure of steam, and the engines working at from 74 to 78 revolutions. On the run of 35 miles to the Bass Rock and back a mean speed of about 11½ knots per hour was attained. The *Ranee* has been specially built for trading between the Straits settlements and the adjoining islands, and her arrangements are all of the most suitable kind for both cargo and passenger traffic in a hot climate.

Lady Katherine.—On April 1st the new steamship *Lady Katherine*, recently built by Messrs. S. P. Austin & Son, the Panns. Sunderland, for the Earl of Durham, left Sunderland on her trial trip, and after it, proceeding on her first voyage to Aberdeen. The *Lady Katherine* is 211 ft. in length, 30 ft. broad, and 16 ft. 8 in. deep. She was built under special survey to class 18 years at Liverpool, and is a very fine vessel. Her nett tonnage is 615, gross 845, and her deadweight carrying capacity, 1,300 tons. She has a full forecastle, a bridge amidships, and a long raised quarter deck. Nothing is wanted for the working of the ship or the loading or discharging of her cargo. There is on board one of Emerson & Walker's patent windlasses, and two steam winches, with one of Smith's patent donkey boilers, the latter being the workmanship of Messrs. Welford & Wigham, King's House Engine Works, Pallion. The decks are of iron, and the hatches are large in size, and on the self-trimming principle. The *Lady Katherine* is rigged as a schooner, with wire rope for fixed rigging. She has swing davits for her boats. The vessel is adapted for carrying water ballast when necessary, and there are cargo holes in the peaks. The engines have been fitted by the North-Eastern Engineering Company, and are known as Allan's patent. They are 90-horse power. The vessel's steering gear is Holliday's latest patent. The vessel left Lambton docks at half-past 4 o'clock, having on board a cargo of coals for Aberdeen. In the roads the compasses were adjusted. The new steamer was then run south to a mile or two beyond Seaham Harbour, and afterwards north to Souter Point. The greatest satisfaction was expressed with the vessel. The steam generated very rapidly in the boilers, and the average speed attained was about 10 knots an hour. The engines worked smoothly and steadily, making 65 revolutions per minute with steam blowing off.

Glenarm.—On April 4th, the steamship *Glenarm*, a steel screw steamer, designed to carry 300 tons dead weight, and steam 10 knots loaded, went on her trial trip on the Clyde. She has been built by Messrs. H. M'Intyre & Co., Paisley, and engined by Messrs. R. H. Pearson & Co., Glasgow. She is intended for limestone carrying, and is built to the highest class at Lloyd's, having steel hull, decks, boiler, &c. She is the first vessel that has been fitted with the new patent anchor housing, and gave great satisfaction to the Owners at the trial trip.

Fairfield.—On April 4th the *Fairfield* (s), built to the order of Mr. Joseph Brown, of Liverpool, had her trial trip from the Tyne. This vessel will have a carrying capacity of 2,200 tons. She was built by Palmer's Iron Shipbuilding Company, and is intended for the general Transatlantic Trade. During the trip, with 1,000 tons deadweight on board, she made a mean speed of 10½ knots per hour. At the termination of the trip she steamed off to Barrow-in-Furness to take in railway iron for Vera Cruz, after which she will proceed to New Orleans to load a cargo of cotton. She will be under the command of Captain Millard.

Agnes Otto.—On April 4th the new screw steamer *Agnes Otto*, recently built by Messrs. John Redhead & Co., Shields, made a trial trip to sea, and ran over the measured mile at a mean speed of 11 knots per hour, and the engines worked admirably. At the conclusion of the trip she returned to the Tyne to load coals at the Commissioners' Staiths for Odessa. She will be commanded by Captain Sprengle.

Gironde.—On April 7th the trial trip took place of the *Gironde* (s), built for the Cardiff Steamship Company (Limited), by C. S. Swan & Hunt, Wallsend-on-Tyne. The *Gironde* is 200 ft. long by 29 ft. 3 in. broad by 15 ft. deep, and is fitted with long full poop, containing passenger accommodation, full forecastle with ballast, iron maindeck, &c. The machinery, of 100-horse power nominal, is by Mr. George Clark, Southwick, Sunderland. The vessel is classed 100 A 1 at Lloyd's, and also the highest class in the Liverpool Underwriters' Book, and is intended principally for the French trade. The engines worked exceedingly well, and the vessel attained a speed of nine knots loaded, at the measured mile, though there was a considerable sea running.

Drummond Castle.—On April 7 the *Drummond Castle*, the most recent addition to Messrs. Donald Currie & Co.'s Castle Line of South African mail packets, proceeded on her trial trip from Wemyss Bay. This screw-steamer is of the same dimensions as the *Garth Castle*, launched by the same builders (Messrs. John Elder & Co.) in December last. In general arrangement the two vessels are nearly identical, the only difference being that in the *Drummond Castle* the promenade deck of 120 ft. in length is carried across the whole breadth of the ship. Her length is 376 ft.; breadth, 43 ft. 6 in.; depth, 32 ft. 9 in.; and her gross tonnage, 3,706. Her passenger accommodation is for 166 first, 84 second, and 124 third class. The engines, supplied by the builders, are compound, with inverted cylinders, the high-pressure is 51 in., and the low-pressure 88 in. by 4 ft. 9 in. stroke. In a special manner the *Drummond Castle* is fitted like other ships of the fleet, for war purposes, the three decks being of iron, and sufficiently strong to carry guns of heavy calibre, while the watertight compartments, of which there are nine, will be of service in the event of the vessel being fired into and damaged below the waterline. Four trials were made, the mean speed attained being 14·65 knots per hour with 2,000 tons of dead weight on board—a result which was regarded as eminently satisfactory by all concerned. The engines indicated 3,552-horse power.

Lockyer.—On April 11th a satisfactory trial trip was made with this steamer. The vessel left the South Dock, Sunderland, with a cargo of 3,100 tons of coal on board, including bunkers, and, as the wind was a little strong, and the sea rather lumpy, a good test was obtained of all her qualities. The steamer maintained an average speed of 9·4 knots per hour, which, under the circumstances, was considered very satisfactory. The *Lockyer* is commanded by Captain Roseberry.

Saxon Prince.—On April 13, this new screw, belonging to Mr. James Knott & Partners, of Newcastle, left the Tyne on her trial trip. The steamer was built by Messrs. C. S. Swan & Hunter, Wallsend, and is intended for the ore and general trades. The engines are by Messrs. R. & W. Hawthorn. The vessel ran the measured mile, 9½ knots against the tide, and 10¼ knots with the tide—there being a strong sea running at the time, which prevented the full speed being ascertained.

St. Donat's.—On April 13th the screw steamer *St. Donat's*, which was launched from the iron shipbuilding yard of the Messrs. Schlesinger, Davis, & Co., at Wallsend-on-Tyne, about a month ago, had a satisfactory trial trip. The speed of the vessel was tested, and the result was most gratifying to all concerned, the engines working smoothly and well. The *St. Donat's* has been built for the St. Donat's Steamship Company (Limited), of Cardiff, the managers being Messrs. Harrison Bros. & Moore, who also own the *St. Fagan's*, built by Messrs. Schlesinger, Davis, & Co. The leading dimensions of the *St. Donat's* are as follow:—Length between perpendiculars, 260 ft.; breadth, moulded, 35 ft.; depth of hold, 20 ft. 4 in. She classes 100 A1 under special survey at Lloyd's. Compound engines of 140-horse power nominal have been fitted on board by Messrs. Thomas Clark & Co.. of Elswick. Captain Tucker, who has also superintended the fitting out, takes command. As soon as the trial trip was over, she loaded 2,204 tons of coal, and, after adjusting compasses on April 23, had a further trial trip, the speed attained being 9½ knots over the measured mile.

Poh Ann.—On April 18th the steamer *Poh Ann*, built by Wigham Richardsou & Co., for Singapore, went from the Tyne for her trial trip. The results were in every way satisfactory, the speed attained being over 11 knots when deeply loaded, the engines developing a power of between 600 and 700 horses, and running perfectly smooth. She is fitted with all the best appliances, including Emerson, Walker & Co.'s Patent Brass Cone Brake Windlass. The *Poh Ann* was built for Mr. W. Lund, of London, and is the third vessel which he has recently ordered from Wigham Richardson & Co.

Bonnie Doon.—On April 19th the Liverpool, Llandudno, and Welsh Coast Steamboat Company's steamer *Bonnie Don*, built for the passenger service between Liverpool and watering places on the North Welsh Coast, had her trial trip, when she attained the speed of 18½ miles per hour. The *Bonnie Doon*, which was built in 1876, possesses a spacious saloon cabin and upper deck, and is fitted with every convenience for passenger traffic. On Saturday last she started on her first trip, and her sea-going capabilities proved most satisfactory, although she had to contend against a heavy cross sea and wind.

Paul (s. t.).—This powerful paddle tug steamer, built by Messrs. Laird Brothers, of Birkenhead, to the order of the crown agents for the colonies, and intended for service in the Mauritius, made her official trial trip on the Mersey early last month, with very satisfactory results. The *Paul* is 130 ft. long, 25 ft. 10 ins. broad, and 15 ft. 3 ins. deep in hold, and is filled with all the latest and most approved towing appliances, while her cabins are arranged so as to render her suitable for use as a tender or despatch vessel should she be required for such service by the authorities of the island. The engines are two independent sets of angled oscillators on the compound system, each pair having two cylinders, 28½ ins. and 47 ins. in diameter respectively, with 5 ft. stroke, and a working pressure of 60lbs. The engines can be disconnected and worked separately, and are specially adapted for tug steamers, from the great facility with which they are handled when disconnected. The speed was tested by six consecutive runs on the measured mile, which gave a mean of 10.9 knots per hour, the mean power developed by the engines during the same period being 941 i.h.p., and both speed and power in excess of contract requirements. When on trial, the vessel had on board, besides her stores, about 75 tons coals in bunkers, which are arranged to stow nearly double that quantity when required for special service.

Brunswick. (s.s.)—This vessel started on a trial trip on the 9th ult, which lasted from noon till six in the evening. She had over 1,900 tons dead weight on board, the total displacement being 2,920 tons on 17 by 11½ mean draft. The cylinders are 29½ in. and 55 in. by 36 in. stroke, with two single ended boilers 11 ft. 6 in. diameter, and four very large furnaces which are of steel as well as fire boxes working pressure 80 lbs. per square in. The mean revolutions during the run, with one of Oldham's four bladed variable pitch propellers were 63, indicated power 640, speed of vessel 9½ knots north and 8 knots south against a strong wind and tide, mean speed of vessel 8½ knots. The vessel has large and handsome cabins amidship, an extra large and strong iron wheel house aft, also large chart room, wheel house and companions on bridge deck, and there is a powerful straw crane aft. The *Brunswick* is the property of Mr. John Bacon, of Liverpool, and is a sister steamer to the *Stuart*, belonging to the same owner. The arrangement is from the design of Mr. Joseph R. Oldham, under whose superintendence the machinery and hull have been constructed by Messrs. Pickersgill, of Sunderland. The engines and boilers are by Mr. George Clark, and it is sufficient to say that they were never stopped once during the six hours' trial trip, nor gave any trouble, and the vessel then steamed right away on her voyage to Barcelona, under the command of Captain Barnes.

Puerto Huergo.—The trial trip of this iron screw tug, built by Messrs. R. H. Green, Blackwall, for the Harbour Works, Bueno, Ayres, took place on March 23rd, when a mean speed of 9·51 knots was obtained on the measured mile. This tug has been engined by Messrs. Alex. Wilson & Co., Vauxhall Ironworks, with two of their compound surfacing engines, each with cylinders 9 in. and 18 in. diameter, 10 in. stroke, similar to that illustrated in our February number, but with the independent pumps placed between the two engines and common to both, exceedingly handy engines for driving twin screws being thus obtained. The dimensions of the *Puerto Huergo* are, length, 65 ft.; beam, 14 ft.; draught 5 ft. 6 in. aft, 3 ft. 8 in. forward. She was superintended for the owners by Messrs. J. Thompson & Sons, and has since started for the River Plate, the voyages throughout being proposed to be made under steam, though the vessel is fitted also with masts and sails.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

March 26th, 1881.

Anderson, Danl. A.	2 C	Aberdn.
Bewley, William .	1 C	Lvrpool.
Evans, Victor E. W.	2 C	London.
Gray, John... ...	2 C	Aberdn.
Hanna, Joseph ...	2 C	London
Henderson, Murray J.	2 C	Bristol.
Hunter, Hugh ...	1 C	Lvrpool.
Kerle, Harry W.	2 C	do.
McCallum, John	2 C	do.
McDougall, John	2 C	do.
Muir, Thomas ...	2 C	do.

April 2nd, 1881.

Anderson, Hugh	1 C	Glasgw.
Arnold, Wm. W.	2 C	Lvrpool.
Bennett, Joseph George	2 C	Lvrpool.
Bragg, George ...	1 C	London.
Bioletti, Harry F.	2 C	Glasgow
Burnett, Geo. L.	1 C	do.
Campbell, John...	1 C	do.
Donnison, Samuel	1 C	Sndrlnd.
Ferrier, Henry ...	2 C	London.
Farquharson, John	1 C	do.
Farquharson, Jas.	2 C	N Shlds.
McFarlane, Andw.	2 C	do.
McFarlane, John B.	2 C	Glasgw.
Mackay, Roderick	2 C	London.
McKellar, Robert	2 C	Glasgw.
McKellar, Jas. L.	2 C	do.
McIntosh, Wm....	1 C	do.
Neale, George E.	2 C	London
Olsson, Carl A.H.	2 C	N Shlds.
Philp, Geo. E. S.	1 C	do.
Purvis, Alexander	1 C	do.
Rae, Thomas ...	2 C	Lvrpool.
Reay, John ...	2 C	N Shlds.
Ross, John... ...	2 C	Glasgw.
Robertson, P. ...	2 C	do.
Smith, Silvester...	1 C	London
Thompson, Thomas C.	1 C	Sndrlnd.
Thompson, J. ...	1 C	Glasgw.
Wright, Matthew W.	1 C	N Shlds.
Wilson, John R.	1 C	N Shlds.
Wildridge, Alexr.	2 C	Glasgw.
Wilson, James ...	1 C	do.

April 9th, 1881.

Atkinson, Matthews C.	1 C	Lvrpool.
Abey, Alfred ...	2 C	Sndrlnd.
Blair, Wm. H. T.	1 C	N Shlds.
Bennett. George	2 C	Hull.
Carver, Wm. J....	1 C	London.
Duncan, Alex. ...	2 C	do.
Fisher, Alexander	2 C	do.
Harrold, Thomas	1 C	N Shlds.
Jones, Hugh ...	2 C	Lvrpool.
Jones, Robert ...	1 C	do.
Kirkwood, Adam	2 C	N Shlds.
Knox, Edward ...	2 C	do.
Mitchell, John G.	1 C	Sndrlnd.
Mace, Septimus F.	2 C	London
Pounder, Alfred...	2 C	N Shlds.
Robinson, Rd. D.	2 C	do.
Tarrie, William ...	2 C	do.
Watson, John ...	2 C	do.
Watson, Edwin...	1 C	do.

April 16th, 1881.

Bennett, Douglas	2 C	Leith
Brown, Wilson ...	2 C	Lvrpool.
Collins, Patrick...	2 C	do.
Dick, James ...	2 C	Leith
Ferguson, Arthur O.	2 C	London
Grieves, Benjamin	2 C	N Shlds.
Jardine, Thos. J.	1 C	Lvrpool.
Jackson, Peter ...	E 1 C	Leith
Kleioz, Jos. H....	2 C	London
Marns, Thomas...	1 C	N Shlds.
Owen, Thomas ...	2 C	Lvrpool.
Ormsby, Henry ...	2 C	N Shlds.
Robinson, Ralph	1 C	do.
Russell, Waller L.	2 C	Leith
Spence, David ...	2 C	do.
Snowball, Wm....	1 C	N Shlds.
Stevenson, David D.	2 C	Lvrpool.
Woods, James ...	1 C	do.

ROBERT JACKSON, Registrar-General.

General Register and Record Office of Shipping and Seamen,
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NEW STEAMSHIP COMPANY IN ATHENS.—A large steamship company is about to be formed at Athens to encourage and promote the shipping trade among the greater seaports of Italy, Greece, and the Levant, and generally to compete with the Austro-Hungarian Lloyd, which has hitherto had the chief Shipping trade in these waters. The capital will amount to about 20,000,000f, and is said to have been already subscribed.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 22nd March to 21st April, 1881.

1254 C. R. F. Schloesser (communicated by D. Rosenkranz and Droop). Steam engine indicators.
1259 J. Dickson and J. A. Mills. Lubricants.
1280 W. Johnson. Variable valve gear.
1282 C. W. King. Steam boilers and combustion chambers.
1285 M. Benson (communicated by P. Jordan). Marine engine governors.
1296 F. Adams. Spring safety valves.
1297 W. Welch. Coating iron and steel ships and decks to prevent condensation.
1306 E. Davies. Compound engines.
1315 J. Snelling. Valves, ports, and gear.
1317 W. R. Oswald. Propeller shaft bearings.
1328 W. Arnold. Boilers.
1329 L. Berry. Valves.
1359 N. D. Spartali. Screw propellers, construction, mode of mounting and working.
1364 J. H. Johnson (communicated by Baron de Winter). Construction of vessels, and apparatus employed therein.
1370 A. J. Boult (communicated by C. Holland). Burning hydro-carbon oils for heat generation.
1375 F. W. Eames and J. McIntosh. Marine engine steam supply regulator.
1386 H. N. Crellin and C. S. Rolfe. Utilizing liquid fuels.
1404 W. H. and J. Sutcliffe. Governors.
1405 D. Blackadder. Piston springs.
1463 R. Hodgson. Raising sunken vessels.
1472 G. W. Robertson. Steam steering gear.
1482 T. English. Subaqueous boring.
1494 J. Gresham. Steam valves.
1496 T. Mudd. Prevention of "racing."
1513 J. Taylor. Grain cargo vessels.
1514 F. W. Willcox. Steering apparatus.
1551 W. Stroudley. Speed indicators.
1552 J. Westberg. Scraping ships bottoms.
1556 W. H. Wise. Wire hawser and cable brakes.
1569 M. Dring and J. Pattison. Fitting shifting boards in grain vessels.
1592 A. Budenberg (communicated by C. F. Budenberg and B. A. Schaeffer). Indicators.
1593 Idem. Injectors.
1620 H. Adams. Fusible plugs.
1632 J. W. de Caux. Deep sea trawling apparatus.
1649 A. J. Boult (communicated by W. C. Seaton). Signals for use at sea.
1652 J. H. Johnson (communicated by J. E. J. d'Arembecourt) Propelling vessels.
1659 E. E. and F. A. Bentall. Mast winches and capstans.
1674 J. Vavasseur. Gun carriages.
1687 H. H. Lake (communicated by F. Utley and J. Fawcett). Stalls, &c., for live cattle cargo.
1693 F. H. F. Engel (communicated by W. R. R. Becker). Automatic deep sea sounding.
1700 W. R. Lake (communicated by F. W. Rainey and F. B. Rogers). Construction of ships in compartments, preventing cargo displacement, and spread of fire.
1708 A. M. Clark (communicated by L. H. Raymond). Boat-plug.
1715 J. Hornblower and G. T. Dove. Steering gear.
1717 A. C. Kirk. Compound Marine Engines.
1724 W. R. Lake (communicated by O. B. Crane, F. M. Platts, and W. H. Homes). Marine engine governors.

⁂ Any information regarding these or other patents will be gladly furnished on application.

Two large steamers are about to be built on the Tyne for a German firm at Singapore. The same firm had previously some boats built on the Tyne.

AN order for steamers has just been booked by Messrs. Scott & Co., of Greenock. The order is for ten screw steamers for the Cochin China trade, and has been received through a French firm. Several other French orders are expected there within the next few weeks. The engines for the 10 steamers will be constructed by the Greenock Foundry Company.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, JUNE 1, 1881.

EDITORIAL NOTES.

IT seems that the adoption of Mr. R. H. Tweddell's system of "hydraulic machine tools" is contributing in no small degree to the successful introduction and manipulation of steel in shipbuilding and boiler yard work. We have so recently described some of these machines that their general features are doubtless fresh in the memories of our readers. The advantages arising from their use in working steel, more especially for punching, shearing, and bending, have been very clearly pointed out in a recent paper read before the Institution of Naval Architects by M. Marc Berrier Fontaine, Ingenieur de la Marine, Toulon. As we commence the publication of the paper itself in this number we need not allude in detail to the results on which M. Berrier Fontaine bases his conclusions, but he distinctly points out the marked improvement due to the substitution of the progressive and steady pressure of hydraulic presses in place of the sharp and violent jar of steam hammers in all work which has to be subjected to sharp changes of form. He also considers as very nearly certain that the action of punches or shears worked on this system must upset the edges of holes or cuts made in steel plates very much less than when the punch or shears are driven by gearing, in which case the tool always reaches its work at considerable speed, producing more or less jar. He makes a further important statement when he adds that the introduction of these machines tends to render less necessary the annealing process. Taking the above results in connection with the recent utterances of Dr. Siemens, it would appear that those who advocate drilling are not going to have it all their own way. As has been frequently pointed out by Mr. Tweddell and others, we should not dispense too hurriedly with punching (which in itself is a cheap and ready form of testing) and, according to Dr. Siemens, is an ordeal which no good steel plate need fear. With care, of course, drilling makes very accurate work, but in comparing the two, good drilling is often compared with bad punching. We have seen some very blind holes in drilled work, and with proper precautions and the use of suitable machinery it is probable that punching will still in many cases be found the best and most convenient mode of making holes. As is often the case, it was not so much the principle which was in fault as that the tools for carrying it out were imperfect. This defect seems now, however, to have been completely and efficiently overcome by the hydraulic machinery, erected under Mr. Tweddell's patents at Toulon Dockyard, and such testimony to their value as that given by Mr. Berrier Fontaine after five years' constant working, is calculated, as we before said, to give an increased impetus to the use of steel in construction, since by their use much of the expense and special precautions hitherto deemed necessary in working up steel are dispensed with.

ROMANCE is seldom more startling than reality, and improbable as many of the fictions in Jules Verne's now well-known whimsical story of "Thirty Thousand Leagues under the Sea" may appear, we are seeing the realization of many of them. Mr. Fleuss has been giving some further practical illustrations at Portsmouth of his new diving dress, which enables him to walk at ease under the water without any connecting pipes or air pump appliances. A diving dress and helmet are only used by Mr. Fleuss for the sake of warmth and comfort under water, neither being in any way necessary to enable him to breathe. The air for respiration he carries down below with him in a compressed condition, concentrated in a little box or tank which is slung over his shoulder like a knapsack. A tube and mouth-piece are so secured to mouth or nostrils that he can draw from his reservoir as desired for respiration, and then return the exhausted gas back again. The impurities formed by respiration are absorbed by a sponge saturated with caustic soda. This apparatus enables the diver to remain under water for a period of three to four hours, without any replenishing of his stock of air. As there are no entangling pipes he can penetrate to situations which would be impossible to the ordinary diver. Mr. Fleuss can descend to the bottom of he Steam Basin, and remain there with perfect freedom of locomotion during any desired time within the before-named limits.

THE same apparatus forms a most valuable protection against suffocating smoke in the case of fire on board ship. Mr. Fleuss in this case dispenses with any external dress, carrying only the same magazine of air strapped to his back, a pair of goggles for his eyes, and the tightly-fitting tube on his nostrils or free respiration. In order to subject this apparatus to a most crucial test, a fire was kindled in a closed shed from all kinds of dockyard waste and refuse, the smoke given off being of the densest and most pungent description. Mr. Fleuss entered the smoking shed, and expressed his willingness to remain there for an hour or more. Those, however, who were witnessing the test considered that the duration of half-an-hour sufficient to prove the perfect success of the apparatus. Mr. Fleuss seemed in no way distressed by the test and could evidently have stayed out his intended time. The result seemed to warrant its adoption as a perfect means of enabling those on board ship to get at fires breaking out in the hold or other inaccessible places. We think this is most important, as the dense smoke usually generated by fire in a closely-packed cargo, invariably drives back those who attempt to get at it, in order to effectually quench it. With this apparatus the position of the fire could be uncovered in spite of the densest fumes, and the hose-pipe thus directed immediately upon the heart of the fire.

SUCH experiments draw our attention to the fact that before long submarine torpedo boats will certainly be constructed, and thus a new and terrible danger menace the fleets of the future. If respiration below the surface of the water and without any communication with the external atmosphere can be so easily maintained for three or four hours, a submarine torpedo boat could noiselessly and unperceived, sink the whole of the strongest ironclad fleet in existence without the presence of the destroyer being once discernible by the ironclads except by its murderous effects. Such a torpedo boat could be dived by compressed air, as in the case of the present Whitehead torpedoes, and could at the same time carry an artificial supply of air, and absorbing apparatus for the vitiated gases, so as to supply the crew for many hours. In fact, we understand Mr. Fleuss is now designing such a boat, and that a Mr. Jones, a Liverpool shipbuilder has already perfected such a model. The prospect for marine battles of the future seems horrible in the extreme. Ironclads with all their gallant crews to be sent to the bottom without warning, and without being able to see the hand that did it. It is difficult to see how such a submarine foe could be combatted at all with the present appliances of defence, but as we have always found that hitherto any mode of aggression has always met its more or less successful means of defence, we will hope that such insidious foes would meet with some novel and formidable form of resistance.

A NEW life-saving beacon is now before the consideration of Admiral Ward and Captain Prouse, the Inspector-General of life-saving appliances. It is the invention of Mr. Sherwell, of Portsmouth, the maker of the Spit bell and other buoys in the Solent. It is considered that many lives might be saved by floating buoys of sufficient dimensions fixed upon or in the neighbourhood of dangerous rocks, banks, or coasts. In some cases safety might be obtained by swimming to such places of refuge when no life-boats or other life-saving appliances might be near. The work also of life boats might be much expedited by landing successive batches of crews upon the buoy, thus saving the repeated journeys of the life-boat to and from the shore. Mr. Sherwell's buoy is a flat-bottomed vessel on which is erected an octagonal dome sufficient to accommodate a ship's crew, and would no doubt be supplied with restoratives and warm wraps for the shipwrecked ones. Access is gained to the structure by means of ladders fitted to the gunwale, and the whole would be surmounted by a bell which would both serve to show the position of the buoy to the shipwrecked sailors, and also serve to indicate the rock or shoal to passing vessels.

THE Italian Government is evidently determined to do all it can to come to the fore in the shape of enterprise both on sea and land. They are now about to undertake an expedition for deep-sea sounding over the whole of the Mediterranean. The necessary arrangements are now being made by Professor Giglioli, the zoologist, at Florence, who will take charge of the biological part of the work. The command of the vessel and the physical part of the work is to be in the hands of Captain Magnagli. It is odd that so little is known of the character of the beds at the bottom of the Mediterranean. The Atlantic though much more inaccessible owing to its greater depth, is still much better known, owing to the frequent soundings occurring during the Atlantic cable laying. There are many scientific questions such as the one whether there is any submarine communication between the Red Sea and the Mediterranean that may be solved by this expedition. The only other known exploration of the depths of this sea is the report of Her Majesty's ship *Porcupine* during a short and imperfect cruise in the year 1870.

THE warrant officers in Her Majesty's Navy seem to have had a substantial grievance of which to complain. They are the only members of the navy that have their pay reduced when in harbour. As their duties are there still as onerous and responsible as when at sea, and as no other officer or man from the admiral to the seaman suffers any similar reduction, it is difficult to explain such an anomaly. The amount of deduction when in port amounts to 9d. a day on the wages, and an extra 6d. a day extra for stores, making a total of 1s. 3d. for each of the days passed in port. As many of the best and oldest of the warrant officers hold harbour appointments they are at once placed on reduced pay just at the time when their services should meet with the best acknowledgment and the greatest comfort. They are now again agitating with the Admiralty for this grievance to be removed. They had already been promised redress by Mr. Ward Hunt, but his sudden death disappointed their hopes. They now, however, hope to have the matter settled to their benefit.

THE iron shipbuilding trade on the Tyne is quite as brisk as ever; most of the firms have orders on hand which will keep their yards busy during the whole of this year.

ON THE EXPERIMENTS WITH THE PERKINS MACHINERY OF THE STEAM YACHT, "ANTHRACITE."

TABLE CONTAINING THE DATA AND RESULTS OF THE EXPERIMENT MADE AT THE NEW YORK NAVY YARD ON THE MACHINERY OF THE STEAM YACHT, "ANTHRACITE," BY A BOARD OF UNITED STATES NAVAL ENGINEERS.—*Continued.*

PER CENTUM OF TOTAL PRESSURE ON PISTONS UTILIZED AS INDICATED AND AS NET PRESSURES.	Mean indicated pressure on the piston of the 3rd cylinder, equivalent to the sum of the indicated pressure on that piston and of the indicated pressures on the pistons of the 2nd and 1st cylinders, reduced respectively in the ratio of the areas of the pistons of the 2nd and 1st cylinders to that of the 3rd cylinder, and for the fact of the 2nd and 1st cylinders being single acting, while the 3rd cylinder is double acting, in pounds per square inch	21·381
	Mean total pressure which applied to the piston of the 3rd cylinder would produce the total horses-power developed by the engine, provided the indicated pressure on that piston was the above 21·381 pounds per square inch	25·591
	Per centum of the mean total pressure on the pistons of the three cylinders utilized as indicated pressure	83·55
	Mean net pressure on the piston of the 3rd cylinder equivalent to the sum of the net pressure on that piston and of the net pressures on the pistons of the 2nd and 1st cylinders reduced respectively in the ratio of the areas of the pistons of the 2nd and 1st cylinders to that of the 3rd cylinder, and with allowance for the fact of the 2nd and 1st cylinders being single acting while the 3rd cylinder is double acting, in pounds per square inch	18·795
	Per centum of the mean total pressure on the pistons of the three cylinders utilized as net pressure	73·44
DIFFERENCE BETWEEN THE WEIGHT OF WATER VAPORIZED IN THE BOILER AND THE WEIGHT OF STEAM ACCOUNTED FOR BY THE INDICATOR.	Difference, in pounds per hour, between the weight of water (1465·11822 pounds) vaporized in the boiler and the weight of steam accounted for by the indicator, in the 1st cylinder at the point of cutting off the steam	831·6088
	Difference, in per centum of the weight of water vaporized in the boiler, between that weight and the weight of steam accounted for by the indicator in the 1st cylinder at the point of cutting off the steam	56·76
	Difference, in pounds per hour, between the weight of water vaporized in the boiler and the weight of steam accounted for by the indicator, in the 1st cylinder at the end of the stroke of its piston	824·6097
	Difference, in per centum of the weight of water vaporized in the boiler, between that weight and the weight of steam accounted for by the indicator in the 1st cylinder at the end of the stroke of its piston	56·22
	Difference, in pounds per hour, between the weight of water vaporized in the boiler and the weight of steam accounted for by the indicator in the 2nd cylinder at the end of the stroke of its piston	562·7648
	Difference, in per centum of the weight of water vaporized in the boiler, between that weight and the weight of steam accounted for by the indicator in the 2nd cylinder at the end of the stroke of its piston	38·41
	Difference, in pounds per hour, between the weight of water vaporized in the boiler and the weight of steam accounted for by the indicator in the 3rd cylinder at the end of the stroke of its piston	147·2538
	Difference, in per centum of the weight of water vaporized in the boiler, between that weight and the weight of steam accounted for by the indicator in the 3rd cylinder at the end of the stroke of its piston	10·05

REMARKS.

Owing to the limited time the *Anthracite* could be placed under the command of the Board of Naval Engineers at the New York Navy Yard, the trial of her machinery was restricted to one experiment, and, consequently, to one set of conditions; but the soundness of the system can be judged only from a number of experiments made under widely varying conditions, and it was the intention of Chief Engineer Loring, had the vessel been long enough at the Navy Yard, to have made a series of experiments on her machinery, with varying boiler pressures and measures of expansion. He intended to have commenced with boiler steam of 74 pounds per square inch pressure above the atmosphere, and, keeping the same measure of expansion, to have made a series of experiments with the boiler pressure increasing 25 pounds per square inch each time; after which, keeping the same boiler pressure, he would have varied the measure of expansion as much as possible, the object being to ascertain whether as good economic results could not be obtained with the lower boiler pressures and less measures of expansion as with the higher boiler pressures and greater measures of expansion, the practically important problem being to ascertain the limit, in both cases, at which increase of economy ceased.

Comparing the economic results obtained during the single experiment made, with those given by ordinary compound engines, it is evident that the latter, with one-fourth the boiler pressure and one-fourth the measure of expansion used with the machinery of the *Anthracite*, produce the power as economically. If the trials are to cease here, the inference follows that the enormous excess of boiler pressure and measure of expansion employed with the machinery of the *Anthracite* have failed to practically realize the economy theoretically predicable, leaving the grave inconveniences of such excess of pressure and expansion unbalanced by any advantage. With this result apparent, it becomes necessary to closely examine the conditions under which the experiment with the *Anthracite* was made.

The boiler pressure does not always represent the initial pressure on the piston, and still less does it represent the mean total pressure on the piston during the stroke; yet it is the latter on which the gain by the use of high pressure must be predicated. Notwithstanding the effect of any superheating which it may be practicable to give in the boiler, the steam in the cylinder is always found to be in the saturated state, that is to say, it has always the maximum density for its pressure, so that it is useless to generate steam at high boiler pressures with the expectation of realizing the economy of producing a given bulk of such pressure over an equivalent bulk of lower boiler pressure, if the former be used in the cylinder with the same mean total pressure on the piston as the latter. To make the mean total pressure on the piston equal in the two cases, the high boiler pressure must be used with a greater measure of expansion than the low boiler pressure, and the gain due to these different measures of expansion may be something or nothing, according to the conditions, but be it what it may, it is entirely distinct from the gain due to the use of steam of the high pressure, *per se*, so that if the high pressure boiler steam be correspondingly expanded in the cylinder to produce the same mean total pressure in its piston as in the case of the low pressure boiler steam, the only gain due to the former will be what results from the higher measure of expansion with which it is used, and not from the higher boiler pressure. This important fact has been overlooked, and a gain under these conditions expected from the high pressure steam corresponding not only to its use with a higher measure of expansion, but also to its generation under a higher boiler pressure. The two cannot be had together. To ascertain what gain can practically be obtained from steam of higher boiler pressure, in function of pressure alone, the experiment must be made using it with the same measure of expansion as in the case of the steam of lower boiler pressure against which it may be tried. This was one of the determinations that Chief-Engineer Loring would have made could he have obtained the *Anthracite* for a sufficient length of time.

Now, during the single experiment with the *Anthracite's* machinery, the measure of expansion employed was so great (25·7098 times) that notwithstanding the high initial pressure on the piston of the first cylinder (201·64 pounds per square inch above zero). the mean total pressure above zero, referred to the piston of the third cylinder, was only 25·591 pounds per square inch above zero, so that in this case the *Anthracite's* engine had no advantage over the ordinary compound engine in function of higher mean total pressure on the piston.

It is quite probable, also, that the measures of expansion employed with ordinary compound engines even when using superheated steam, say from six to ten times, give as high an economy as can be obtained from greater measures, owing to the enormous cylinder refrigeration which attends the use of steam expansively, and which is *pro rata* to the total power developed by the expanded steam alone. If such be the fact, and all experiments thus far show it, then there is no reason to expect any higher economic results from the *Anthracite's* machinery for the conditions under which it was tried at the navy yard than were actually obtained. They were equal to those of an ordinary compound engine, and nothing more.

But it is quite possible that other conditions would have given a higher economy for the *Anthracite's* engine. Had, for instance, the same initial pressure on the piston of the first cylinder been maintained with the steam expanded, say six or ten times only, then, supposing nothing of economy to be lost by the decreased measure of expansion, there would have been the gain due to the resulting higher mean total pressure on the piston in function of pressure only, and to the fact that the same final back pressure would have been a less per centum of the mean total pressure above zero; in other words, more of the mean total pressure on the piston would have been utilized as indicated, or as net pressure. Probably, however, the boiler could not supply the engine with the increased quantity of steam, in equal times, that these conditions would require, and, if it could, the rate of combustion of the coal would have to be largely increased, which would have been attended by a decreased economic vaporization, so that although an economic gain might have been obtained according to the water measure, or weight of steam consumed, yet a loss might have been experienced according to the coal measure. It is so impossible to change one condition in engineering without changing all or many, that it is unsafe to infer what would follow from a given change in one direction. Only the actual trial or appeal to Nature can be relied on each time.

It is true that any better results obtained with the water measure could be obtained with the coal measure also, by reducing the dimensions of the cylinders so as to develop the same power in each case with the same initial pressure on the piston. This, however, requires a new engine, and could not be realized with the machinery of the *Anthracite*.

Nor must the fact be omitted that with each increase in the initial pressure on the piston, the back pressure against it remaining constant, there results increase of cylinder condensation due to the increase in the difference between the temperature of the initial pressure and that of the back pressure. Each theoretical gain is attended with its inseparable practical loss, so that only a very small margin of difference seems possible in any case, and herein lies the true explanation of the failure, total or partial, of the many promising schemes and ingenious mechanisms for cheapening the cost of steam power in fuel.

In comparing the economic efficiency of steam of exceptionally high pressure and measure of expansion against that of steam of comparatively low pressure and measure of expansion, care must be taken that the degree of superheating be the same in both cases. Now, a considerable degree of superheating will increase the economy of any steam from 15 to 30 per centum according as the engine using it is a large or a small one, and superheating is as practicable with steam of one pressure as another. When a high degree of superheating is employed with high pressures and measures of expansion, discrimination must be made between what is due to it and what is due to them.

The great economic gain certain to follow the use of a high degree of superheating is a great temptation to employ it, especially for trials too short to develop its injurious effects on the metal of the cylinder and valves, and on the superheating apparatus itself. A prolonged use of any high degree of superheating has always been followed by such decrease in the durability and reliability of the machinery that, often as it has been attempted just so often has it been abandoned, consequently, notwithstanding the great economy given by it, it is in practical use nowhere. A very moderate degree of superheating is all that can be permanently maintained.

In the boiler of the *Anthracite*, extensive provision was made for highly superheating the steam, the superheating surface being twenty times the area of the grate surface and equal to the water heating surface, an excessive proportion, as compared with the five to eight times of the grate surface, which is usually given with large superheaters. The temperature of the gases of combustion in the chimney during the navy yard experiment averaged 700 degrees Fahrenheit, as obtained from the melting points of different metals suspended in the chimney; yet, notwithstanding the great extent of superheating surface and the high temperature of the gases of combustion upon it, the steam during the navy yard experiment did not appear to be much superheated. This can only be accounted for on the supposition that the steam was very wet when it went upon the superheating surface, owing to the priming or foaming of the boiler. It is greatly to be regretted that the temperatures of the steam on leaving the boiler and on entering the valve chest of the first cylinder were not taken during the navy yard experiment. This is the only important omission in the data; these temperatures would have shown the degree of superheating with certainty, whereas it can now only be inferred. The proper thermometers for the purpose were provided, but they were not inserted in position owing to the want of time to make the extensive connections required.

During the navy yard experiment the boiler was worked with the very moderate rate of combustion of about 12 pounds of coal per hour per square foot of grate surface, which was doubtless above its economic limit. All boilers of this description, that is, composed of small tubes in direct contact with the fire and connected continuously, the boiler not having a proper area of water surface for the disengagement of the steam, nor a proper capacity, and, more especially, proper height of steam room for the separation by gravity of the carried up water from the steam, prime or foam violently when worked above a low rate of combustion. This result is inevitable, and such boilers are only fit for low rates of combustion, and even then require large proportions of water heating and steam superheating surfaces to give good economic vaporizations. As the rate of combustion is increased, so is the priming or foaming, and although the economic vaporization may up to a certain point be maintained by the conversion of the steam superheating into water heating surface by the priming, yet the superheating effect is thereby lost. If the rate of combustion be increased to 15, 20 or 25 pounds of coal per hour per square foot of grate surface the water will be driven by the heat entirely out of the lower tubes, and they will be quickly destroyed. A very great deal of this type of boiler is required in proportion to the power developed. It is neither durable nor reliable, particularly in ignorant or careless hands.

A proper test of this boiler requires it to be worked during a moderate time at the usual rate of combustion for steamers, say 20 pounds of coal per hour per square foot of grate surface. Its durability, its economic vaporization and its steam superheating would then become manifest; but experiments at rates of combustion considerably below what is necessary in practice only mislead.

The *Anthracite* has made two voyages across the Atlantic between Liverpool and New York, say 6,500 geographical miles, and this was intended as a test and proof of the durability and reliability of her machinery. But the voyages were made at an exceedingly low rate of combustion, only about two indicated horses-power being developed for each square foot of grate surface, which evidently does not meet the objections, and leaves the problem just where it was. The fact at issse is: can the vessel without injury to her machinery make two consecutive voyages across the Atlantic at the rate of combustion employed by the ocean steamships running on the same track? The chimney of the *Anthracite* was so short that 12 pounds of semi-bituminous coal per hour per square foot of grate surface was as high a rate of combustion as could be permanently maintained. Had the vessel remained sufficiently long at the New York navy yard for exhaustive experimenting, her chimney would have been temporarily lengthened to about 55 feet above the grate, and all the coal burned that the draught would consume.

The great tendency of the boiler of the *Anthracite* to foam is evidenced by the fact that while the area of the steam port of the first cylinder is $\frac{1}{15}$th of the area of the piston, it was deemed prudent to make the cross area of the steam pipe less than $\frac{1}{27}$th of the area of the piston, thus providing for a great and permanent throttling of the steam beyond the control of the persons operating the engine. The extent of this throttling was such that whereas the boiler pressure during the experiment was 331·23 pounds per square inch above zero, the initial pressure on the piston of the first cylinder was 201·64 pounds, the throttle valve being wide open, the difference was 129·59 pounds.

That the steam had but little superheating when entering the first cylinder, probably not exceeding 50 degrees Fahrenheit, the most of which (35 degrees) was due to the throttling, appeared from all the indications. The packings of the valve stems and of the piston rods were unaffected; the steam when blown into the air did not look as though it was much superheated, and the condensation of steam in the first cylinder was enormous, exclusive of what was due to the developement of the power. This condensation at the point of cutting off the steam in the first cylinder was 56·76 per centum of the entire weight generated in the boiler, and was maintained to the end of the stroke of the piston of that cylinder. In the second cylinder, owing to re-evaporation, this condensation fell at the end of the stroke of its piston to 38·41 per centum of the entire weight generated in the boiler, while at the end of the stroke of the piston of the third cylinder it fell further to 10·05 per centum by the continuance of the same cause.

This enormous cylinder refrigeration was due to the enormous measure of expansion (nearly twenty-six times) with which the steam was used, to the great difference between the temperature of the initial steam in the first cylinder and that of the back pressure steam in the third cylinder, and to the small dimensions of the cylinders whereby their inner surfaces, including the extensive surfaces of their disproportionately large steam passages, became very great relatively to the weight of steam contained. To counteract these cooling causes would require the steam to be very highly superheated, and provision for obtaining that effect was made by giving the boiler an enormous extent of superheating surface, but the necessary superheating was not obtained with the water carried at the experimental level, due doubtless to the priming or foaming of the boiler, notwithstanding the great throttling with which the steam was used.

A sensible proof of the enormous cylinder condensation in the case of the experiment on the *Anthracite* at the New York navy yard was furnished whenever a set of indicator diagrams was taken. On opening the cock in the indicator pipe of the first cylinder a steady flow of water streamed from it, of the full area of the cock opening, and with considerable velocity, and continued unabated as long as the cock remained open, making the taking of diagrams very troublesome. When the cock in the indicator pipe of the second cylinder was opened, the same flow of water took place, and continued as long as the cock remained open, but the issuing quantity of water was much less and it flowed with much less velocity, the pressure being greatly less than in the first cylinder. When the cocks in the indicator pipes of the third cylinder were opened, no water came forth at any part of the stroke of the piston.

The engine during its working gave no indication of the enormous quantities of water of condensation passing through the cylinders; there was no slapping noise or noticeable jar, the entire mass of steam condensed during the steam stroke of the pistons being re-evaporated during the latter part of that stroke and the whole of the exhaust stroke under the lessening pressures by the heat contained in the water of condensation and in the metal of the cylinders on which this water rested.

The theoretical gain due to very high steam pressure worked in a cylinder with a low and constant back pressure, and to using it very expansively, is practically lost in greater refrigeration which inseparably attends both to a greater degree than with steam of lower pressure worked less expansively, and although the resulting condensation may be in a great measure prevented by previous superheating, yet if the same quantity of superheating be given to the lower pressure and less expanded steam, the latter would be proportionally benefitted, and the relative economy of the two perhaps not much changed.

It is of the greatest importance to mankind that there shall be discovered the pressure of steam, the measure of expansion, and the degree of superheating which will produce the highest economic results from the fuel, without prejudice to the durability and reliability of the machinery, and without requiring exceptional care and skill in its management. The attempt made to solve this problem by the construction of the machinery of the *Anthracite* is in the right direction, and most praiseworthy, and it will be a subject of lasting regret should a series of exhaustive experiments be not made with it. The mechanism is at hand, and all that is needed are the services of skilled and sagacious experimenters animated by the love of truth alone.

TRIAL OF SCREW PROPELLERS.—Captain George Peacock, F.R.G.S., of Starcross, Devon, has lately had built by Mr. Dixon, of Exmouth, a steam galley for a pleasure yacht on the river Exe, in order to try a "cycloidal propeller" invented by him some years since. The engine and boiler, of about 4-horse power, were constructed by Messrs. Cochran & Co., of Birkenhead. The yacht is called the *Flying Dutchman*, and took the water on Tuesday last in the Birkenhead Float, when a series of trials was instituted with three different kinds of propellers. The first trial, of four runs, was made with an ordinary two-bladed screw propeller of the most approved form and pitch; the next with a three-bladed propeller of same area; the latter beat the former by three quarters of a knot an hour, and with less vibration; four runs were also made with this propeller, which concluded the trials for Tuesday. On Wednesday, May 18, Captain Peacock's patent cycloidal propeller, of same area as the other screws, was attached to the shaft, and four runs made, beating the first screw by nearly two knots an hour, and the second by upwards of a knot, and with scarcely any perceptible vibration. The draught of water was the same on all three trials; on one occasion, going before the wind, it is mentioned that she made with the cycloidal propeller nearly 10 knots.

THE INSTITUTION OF CIVIL ENGINEERS.

ON TORPEDO BOATS AND LIGHT YACHTS FOR HIGH SPEED STEAM NAVIGATION.

AT the meeting on Tuesday, the 10th of May, Mr. Brunlees, F.R.S.E., Vice-President, in the chair, the paper read was by Mr. John Isaac Thornycroft, M. Inst., C. E.

The total weight or displacement of a vessel was divided by the author into three components:—1st, the structural hull; 2nd, the propelling machinery and apparatus; 3rd, the load. In considering how the two conditions of lightness and sufficient power might best be attained, the author directed attention chiefly to the treatment of the second component, and the means which had been adopted for reducing the weight of the propelling machinery and apparatus, and, in consequence, the weight of the hull also. For this purpose, rapid combustion of fuel, sub-divided flue way, high-steam pressure, and high-speed of engine had been brought into action, following the initiative taken in the perfecting of the locomotive engine as the embodiment of extreme lightness and concentration of power. For promoting the draught of marine boilers, the fan appears to be the most convenient instrument for forcing air into the stokehole, which was thus kept moderately cool. The author devised the fan-blast in this form for the boilers of the yacht *Gitana*, built by him in 1876, and it had been found to work efficiently. The pressure of the blast was measured by a column of water of from 3 in. to 6 in. high. The greater part of the pressure was exerted in overcoming the resistance of the flue-tubes of the boiler.

The author proceeded to examine into the relative weight and form of hull best adapted for carrying the load and the machinery. He illustrated by diagrams the form of hull employed for second-class torpedo boat, showing the distribution of displacement with regard to the lengths of the boats, with a curve for each boat, in which the ordinates represented the areas of immersed section. A curve, constructed in this way, taken from the *Iris*, was exhibited. Though the most favourable position of the propeller for high speeds was astern of the rudder, yet it was frequently preferred, for the sake of better steering qualities, to place the screw in advance of the rudder. On the question of immersion, the author referred to experiments recently made by him on a model propeller; from which it appeared that when the propeller was totally immersed, the useful effect was equal to about seven-tenths of the power expended; and when it just broke the surface of the water, the efficiency did not exceed five-tenths of the power expended.

The light yacht, *Gitana*, was described in its main features. The hull was 86 ft. long at the water line, and a breadth of beam of 10½ ft., the extreme breadth being 13 ft. 3 in. The draft was 1 ft. 1½ in. forward, and 4 ft. aft; the displacement was 29 tons. The engines were compound, with an intermediate receiver, and injection condenser; having three cylinders—one 13½ in. high pressure, and two 15 in. low pressure, with a stroke of 16 in. The air pump was 23 in. in diameter, with a stroke of 3 in. The blowing fan was 3½ ft. in diameter, driven directly from a 5 in. steam cylinder, and made 900 revolutions per minute. The propeller was a screw of 5½ ft. in diameter, with a pitch of 8½ ft., placed abaft the rudder. The boiler was of the locomotive type. The framing of the engine consisted of small steel columns, directly connecting the cylinders with the bed-plate, and placed as near to the main bearings as possible. These columns were braced together near the centre of their length, and were only adapted to resist vertical forces. The framing depended for its transverse stability on its connection with the hull, to which the cylinders, and lower ends of the guide bar, were fastened by stays. For securing lightness of moving parts, the pistons were made of wrought steel; the piston-rods and connecting-rods were also of steel, the piston-rods being bored out. The cranks, the crank-pins, and the lower halves of the connecting-rods, were balanced by cast iron balance-weights, secured to the cranks by steel bolts.

A first-class torpedo-boat was next described, 87 ft. in length, with 10½ ft. beam. The engines were compound with a receiver, having two cylinders respectively 12¾ in. and 20⅝ in. in diameter, with a stroke of 12 in. The condensing water was forced through the condenser by a centrifugal pump, assisted by a special form of grating, which by gradually expanding openings, converted the external relative velocity of the water into pressure. The slide valves of the engines were balanced by being placed under bridges, which were made with recesses corresponding to the ports in the cylinders, as used by Mr. Wilson, of Patricroft. The four packing-rings of the pistons were of Perkins' metal. The feed pumps were worked by a cast-iron worm on the engine shaft, geared into a wheel of phosphor-bronze, on a shaft having a crank at each end to work two feed pumps. The engine-room also contained a bilge-pump, and an air-compressing pump, with a separate engine for charging torpedoes. The propeller was constructed with three blades, and was placed forward of the rudder; it was 4½ ft. in diameter, with a pitch of 6 ft. The boiler was of the locomotive type, with a working pressure of 126 lb. A rose with an ejector was provided, to extinguish the fire in cases when it was required to be put out, and could not be drawn. There were self-closing ashpit-doors, preventing the return of vapour to the stokehole. A passage to the deck was also provided, to facilitate the escape of the steam discharged in the event of a tube giving way.

Boiler Trials, First-class Torpedo Boat No. 3.

Air pressure in stokehole	inches	2	3	4	6
„ ash-pit	„	1·47	2·29	3·26	5·25
„ furnace	„	1·35	1·87	3·0	4·33
Temperature, feed-water	Fahr.	53·5	57	54	56
„ funnel	„	1073	1192	1260	1444
Steam pressure (above atmosphere)...	lb.	117	117	115	115
Coal consumed per hour	„	925	1177	1472	1815
„ „ per square foot of firegrate	„	49	62	78	96
Water evaporated per hour	„	6530	7770	9320	10,840
„ „ per lb. of coal	„	7·06	6·6	6·33	5·97
Evaporation per lb. of coal reduced to equivalent at 212° Fah. from 100°		7·61	7·08	6·81	6·41
Evaporation per hour per square foot of heating surface ...	...	10·8	72·9	15·5	18·0
Coal used, Nixon's Navigation. Ashes, 9 per cent.	...				
Duration of experiment	...	H. M. 2 0	H. M. 2 7	H. M. 1 39	H. M. 1 27

Experiments had been made at Portsmouth to ascertain the performance of the boilers of the first-class torpedo boats, the results of which were given as in the annexed table.

The influence of the pressure of air employed on the rate of evaporation and of combustion, and on the temperature of the gases leaving the boiler, was clearly manifested. The measurement of the pressure in the stokehole, ashpit, and fire-box showed that of the initial pressure the resistance of the tubes accounted for about seven-tenths of the whole, the resistance of the fire and fire-bars being only about one-tenth. The loss on entering the ash-pit appeared too large, and the indicated deficiency of pressure under the bars was perhaps partly due to the comparatively high velocity of the air at this part of its transit. The second-class torpedo boat was 60 ft. in length, with a beam of 7¼ ft.; the draught was 12½ in. forward, and 3 ft. 4 in. aft.; the displacement was 10·6 tons. The engines were compound, surface-condensing, and worked up to about 112 indicated H.P. The working cylinders were 7 in. and 11 in. respectively in diameter, with a stroke of 8 in. The air-pump, actuated by levers. was 7 in. in diameter, with a stroke of 2 in. Two feed-pumps were worked by worm and wheel, as described for the first-class boat. The circulation of the water in the condenser was effected entirely by an apparatus by which the external motion of the water when the boat was moving was utilized. An ejector was also fitted for removing air from the water-space of the condenser, which was partly above the load water-line. By this apparatus sufficient circulation could be maintained, when the boat was at rest, to condense any steam that might be required to be condensed in order to prevent its escaping into the air. A small engine was used for blowing the fires, similar to that described for the first-class boats; but it was made to drive two pumps, which could be connected when required. These boats were designed to be carried on board ship, and they required to be slung overboard complete and ready for use. This condition involved their being subjected to considerable stresses, and the effect of their being thus suspended was illustrated by diagrams. The paper concluded with three tables—of the proportionate weight of the hulls of sea-going vessels, and the torpedo-boats and yachts, that had been described; of the relative performance and weight of steam-vessels and locomotives; and of the relative displacement and performance of steam-vessels.

MILD STEEL IN FRENCH ARSENALS.

On the Use of Mild Steel for the Construction of the Hulls of Ships in the Arsenals of the French Navy.[*]

By M. MARC BERRIER FONTAINE, Member.

THE Council of the Society having thought that some of its members might take some interest in being acquainted with the conditions under which mild steel is actually in use in the arsenals of the French Navy for the construction of the hulls of ships of all classes, I am pleased to be able to satisfy the wish which has been expressed to me on this matter, after having obtained from the Ministry of Marine the necessary authorization.

I doubt, however, whether the information which it will be possible for me to give in the following note will add any very important matters of experience to those which have already been set forth by Messrs. Barnaby, Riley, Denny, Martell, and West, in the remarkable communications which have been read by them at former meetings of the Institution.

If, in fact, the French Navy can justly claim the merit of having been the first to undertake boldly the substitution of mild steel for iron in the construction of the hulls of its largest fighting ships, it is necessary to admit that the British Admiralty very quickly followed in this line.

If the French builders on their side can pride themselves on having been the first in a position to produce plates, angle-irons, and bars of all sections, presenting all the qualities of ductility, malleability, and homogeneity necessary to permit of their being used safely in the construction of warships, without its being necessary to have recourse to too delicate methods of work, it is also just to do credit to the wonderful rapidity with which the iron works of Great Britain have succeeded in obtaining steel plates and steel angle-irons, fulfilling in the most satisfactory manner all the difficult conditions which had been clearly pointed out to them by the Admiralty.

We may now therefore, I think, admit that in a general way the experience and skill of the mild steel makers are about equal on the two shores of the Channel, and that a corresponding equality presents itself in the experience and skill of the builders who have been able to work this steel in the naval yards, both public and private, of the two countries.

It was on March 10th, 1873, that the contracts were entered into at Lorient for furnishing the plates, angle-irons, and mouldings in steel, necessary for the construction of the first-class armour-plated ship, the *Redoubtable*, which is entirely built of steel, with the single exception of the external plating of the wetted hull down to the lower armour shelf. The provision of this material it was possible to divide even at this time between two different works, that of *Creusôt* and that of *Terrenoire*. The keel of the *Redoubtable* was laid on July 10th in the same year. About the same time, in August, 1873, the keels were laid of two other large vessels, also built throughout of steel, with the exception of the external plating of the wetted hull—the *Tonnerre*, a coastguard ship of the first class, at Lorient, and the *Tempête*, a coastguard ship of the second class, at Brest. I may here mention that the idea of the almost exclusive employment of steel in the construction of these first three ships belongs exclusively to their designer, Mr. L. de Bussy, then naval engineer at Lorient, and now director of naval construction at Paris. The quality of the steel employed in these constructions and the processes of working it have been completely described by M. J. Barba, then naval engineer at Lorient, and now chief engineer of the works of *Creusôt*, in his "Account of the Use of Steel in Naval Construction."[†] In the month of October, 1874, Admiral Sir W. Houston Stewart, Controller of the British Navy, and Mr. N. Barnaby, Director of Naval construction, took the opportunity of seeing for themselves, and of studying on the spot, the use of steel in the dockyards of Lorient and Brest. In the excellent communication on iron and steel for shipbuilding, read on the 19th of the following March before this Institution,[*] Mr. Barnaby gave an account of his observations during this visit, and pointed out in the clearest and most precise manner to the steel makers of Great Britain all the indispensable conditions which must be satisfied by the plates and mouldings in steel, so that they may be used with full confidence in the construction of the largest ships. The conditions to be fulfilled having thus been clearly stated, it was not long before the steelmakers of Great Britain were in a position to satisfy them. The Landore-Siemens Company was the first to be able to fulfil them, and before the end of 1875, that company was in a position to contract with the Admiralty for the plates and angle-irons necessary for the construction of two cruisers of high speed, the *Iris* and the *Mercury*. These plates and angle-irons were made from steel obtained by the Siemens-Martin process. Shortly afterwards the Bolton Steel Company was in its turn able to produce, by the Bessemer process, plates and angles satisfying all the requisite conditions. The Steel Company of Scotland, Butterley Company, and other important works have also entered into the same business, and we are at last able to put full trust in the quality of steel furnished by these different Works, as is now fully admitted by the Constructors of the Navy, the officers of the Board of Trade, of Lloyd's Registry, and the Liverpool Registry, and all the most competent authorities. Nothing could well be more instructive than a comparison of the doubts and hesitation expressed by Mr. Barnaby in 1875, and the unlimited confidence expressed by Messrs. W. Denny and West in 1880. This is perhaps the best proof that could be given of the marked progress made in England in this matter in the short space of five years.

But while the steelmakers of Great Britain were thus progressing so rapidly and remarkably in the quality of their output, their competitors on the Continent were far from remaining inactive. On our side of the Channel, too, the manufacture of steel continued to make important progress, especially in respect of the homogeneity and proved uniformity of the material turned out.

The steady and progressive improvement in the qualities of steel which are delivered to the French Navy cannot be doubted. It is established by the result of all the trials to which the material has been submitted under the eyes and under the direction of the naval inspectors before leaving the works. The proportion rejected by these has been steadily diminishing, and is now very small indeed. The ironmasters, moreover, have so completely mastered the quality of their steel that they can obtain with certainty qualities satisfying all the conditions for acceptance imposed upon them by the Navy,[†] although not giving results markedly superior to those required by the conditions. For instance, for plates from 6 mm. to 20 mm. thick, for passing which the breaking weight must reach at last 45 kilogs. per square millimetre, and the extension at the moment of breaking must be at least 20 per cent., the ironmaster will naturally endeavour to obtain plates which give under test results slightly in advance of those which have been pointed out, so as to make sure that the plates will not be thrown upon his hands; but he is now able to settle beforehand his process of manufacture, so as to obtain products of uniform equality with such precision that he can cut down almost to nothing the margin of safety that he needs to reserve. He will thus make his arrangements to produce plates, which, upon testing, will seldom give more than 48 or 49 kilogs. breaking weight per square millimetre, or more than 22 or 23 per cent. of corresponding extension. This certainty in the processes of manufacture, moreover, is not the peculiar possession of any one manufacturer. All the works without exception, which furnish the navy with plates and moulded bars, are at the present moment in a condition to produce with certainty material whose tests will lie between limits equally close. This has been proved in the clearest manner by the results of the tests constantly made in the different works.‡ Thus not only do the products of any definite works present a constancy of quality and remarkable homogeneity, but this constancy of quality and this homogeneity may also be found in the produce of all the different works to such an extent that it would not be possible to distinguish the one from the other, the produce of different works, were it not for the manufacturers' mark stamped on each plate or each bar.

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[*] Paper read before the Institution of Naval Architects.

[†] One vol. 8vo., 1st edition, 1874; 2nd edition, 1875; published by J. Baudry, Paris and Liège.

[*] Transactions Institution of Naval Architects, vol. xvi., 1875. p. 131.

[†] See the Conditions of Acceptance, Appendix A.

It must be added that this valuable quality of almost perfect homogeneity is not a consequence of the exclusive use of any particular process of manufacture. Steels made by the Siemens-Martin process and those turned out by the Bessemer process may now be regarded as absolutely equal in this respect, and the navy has been able now for several years to admit with complete indifference the material turned out by both these processes, the names of which are not even mentioned in the terms of contract. Several manufacturers employ both processes simultaneously. If some of them reserve their Bessemer converters for the production of steels relatively of inferior quality, such as those for rails, and keep their Siemens-Martin converters for the production of superior qualities which have afterwards to be rolled into plates or bars for ships, other works, exactly reversing this plan, make rails from their Siemens-Martin Steel, and reserve the produce of their Bessemer converters for plates and bars for the Navy.

(*To be continued.*)

THE INFLUENCE OF CUT-OFF AND LENGTH OF CONNECTING ROD ON THE WORKING OF STEAM-ENGINES.

By C. E. STROMEYER, Esq., Engineer Surveyor to Lloyd's Register.

[Read at the Twenty-Second Session of the Institution of Naval Architects, 7th April, 1881; the Right Hon. the Earl of RAVENSWORTH, President, in the Chair.]

IN bringing before your notice a few tables which I have compiled on the friction of some of the working parts of an engine and the uniformity of motion, and their relations to the cut-off and length of connecting rod, I hope that the information may be found not without value in the present day, when, as it appears, both the type and the pressure of steam-engines may undergo a radical change.

The classification of the different frictions occurring in an engine has seldom been attempted in such a manner as to make apparent their relations to the several dimensions; it will therefore be necessary to submit a few remarks on this subject before explaining the tables and diagrams, and the principle on which they have been calculated. The frictions of an engine can be divided as follows:—

Those depending only on the dimensions; those which depend chiefly on the weights; and those which depend partly on the dimensions, but chiefly on the adjustments, such as the packing of glands and pistons. Most of this last-mentioned friction is a function of the skill or carelessness of the men who attend to the working, and is, therefore, inestimable, but there are certain limits below which it can never fall; they depend on the dimensions and nature of the surfaces, and on the lubricants. Nothing, or very little definite, is as yet known about this subject, but it is at least probable that the friction increases both with the initial pressure and with the circumference of the rod or of the piston, and also that the lengths of the packing in the glands and heights of piston rings are important factors, though whether the friction increases directly or inversely as the length, or whether there is a certain length which gives the best result, is not known.

Of the other frictions, that produced by the weights of revolving and sliding machinery can be so easily ascertained for individual cases, that it will not be necessary to refer to it here. Then there is the slide valve friction, which does depend to a great extent on the expansion of the steam, but is entirely independent of the length of connecting rod. The remaining frictions are produced between —1, crosshead and guide bars; 2, gudgeon and crosshead; 3, bottom end and crank pin; and 4, crank shaft and main bearings. As the coefficient of friction has been pretty accurately determined, and as it is at least certain that it will not greatly vary in different engines in which the same lubricants are used, the above losses can all be brought into formulæ, comparing them with the indicated work and with other engines in which the dimensions have been altered. The following short list contains the notations employed in the formulæ, on the friction and on the uniformity of motion:—

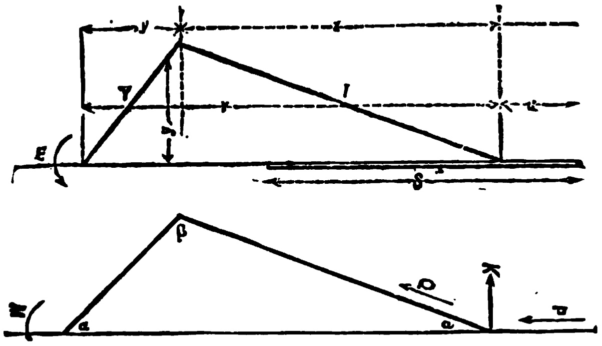
s = length of stroke = $2r$ = twice length of crank.
l = length of connecting rod.
P = load on piston rod.
K = normal pressure on guide bars.
Q = thrust in connecting rod.
M = turning moment on shaft.
u = position of top end from top of stroke.
h, v, x, y, fixed position of crank pin.
α = angular position of crank.
β and γ = complementary angles to α.
ϕ = coefficient of friction.
M = mass of piston and rods.
T = moment of inertia of fly-wheel.
I = moment of inertia of connecting rod.
I H P = indicated horse-power.
ω = angular speed.
$d\,2$ = diameter of crank pin.
$d\,3$ = " crank shaft.
$d\,4$ = " gudgeon.

It will be seen that— $\cos\alpha = \frac{y}{r}$,

and by making several simple substitutions it will be found that—

$$\cos\alpha = \frac{u^2 + v^2 - l^2}{2\,v\,r}.$$

With the help of this formula the values of cos α, α, sin α were tabulated for twelve different values of u and for eleven different values of l, ranging from $\frac{3}{4}\,r$ to ∝. Then diagrams were constructed representing the friction according to the two following formulæ:—



$$\text{Guide friction } d f_1 = -\phi\,K\,d u = -\phi\,P\,\frac{h}{x}\,d u.$$

Crank pin friction

$$d f_2 = -\phi\,Q\,\frac{d^2}{2}\,d\beta = -\phi\,P\,\frac{d^2}{2}\,\frac{L}{x}\left(1 + \frac{y}{x}\right) d\,\alpha.$$

The friction at the journals is almost the same as that of the crank pin, and the friction of the gudgeon is so very small that they have not been worked into the shape of a table. The formulæ are—

$$\text{Crank shaft friction } d f_3 = -\phi\,Q\,\frac{d_3}{2}\,d\alpha = -\phi\,P\,\frac{d_3}{2}\,\frac{l}{x}\,d\alpha.$$

$$\text{Gudgeon friction } d f_4 = -\phi\,Q\,\frac{d_1}{2}\,d x = -\phi\,P\,\frac{d_4}{2}\,\frac{l y}{x^2}\,d\alpha.$$

With the help of the table containing the values of α, cos α, sin α, h, y, and x, could easily be found, and with their help about 130 diagrams were constructed; the area of each one was measured, compared with the indicated work, and the result given in Tables and Diagrams I. and II. As will be seen, Tables I.*a* and II.*a* are worked out for six different lengths of connecting rods, varying from ∝ to $\frac{3}{4}$ of piston stroke, and for ten different diagrams, the cut-off varying from $\frac{1}{10}$ to $\frac{10}{10}$, and also for a triangular diagram. Tables I.*b* and II.*b* will probably be found more handy than the others, marked I.*a* and II.*a*, as here the values are classed according to the mean pressures, and not according to the cut-off; in every other respect the two tables are identical. There is a decided difference in the crank-pin friction during the up and the down stroke, the loss during the down stroke (irrespective of piston weight) being greatest, but as there are only few engines which work with steam on one side of piston, the tables have been simplified by giving the mean values. The use to which they can be put will be plain from their appended explanation, but in case it should be thought necessary to find the friction for diagrams which are not contained there, the following examples may be of help:—

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‡ See Appendix B for an analysis of a great number of these tests applied to steel plates and bars delivered at the Toulon yard.

In the diagram of an engine in which the connecting rod = 2 stroke (Fig. 3) and cutting off at $\frac{3}{10}$ stroke with a back pressure of ·12 P, the mean pressure would be ·40, because the area of A B C D E is ·52 P., of E F G D it is ·12 P., and therefore that of A B C G F is ·40 P. The coefficients are—

	Crank friction.	Guide friction.
For the first area	1·074 ...	·187
For the second	1·018 ...	·184
The coeff. for the difference is ...	1·091 ...	·185

because—

$$\frac{1·074 \times ·52 - 1·018 \times ·12}{·52 - ·12} = \frac{·43632}{·40} = 1·091,$$

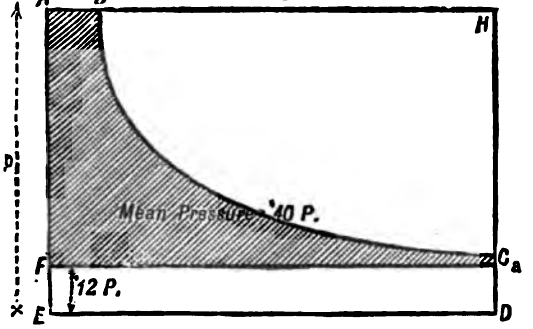
because—

$$\frac{·187 \times ·52 - 1·94 \times ·12}{·52 - ·12} = \frac{·07396}{·40} = ·185.$$

The friction of a diagram of the shape of Fig. 4 can be found in the same way. Let the initial pressure be represented by 1 and the end pressure by ·5, then the mean pressure will be ·75, if the connecting-rod = 3 strokes, the coefficients will be as follows:—

	Crank friction.	Guide friction.
Triangular diagram	1·006 ...	·194
Lower diagram	1·008 ...	·194
Coeff. of entire area	1·007 ...	·194

Fig. 8.

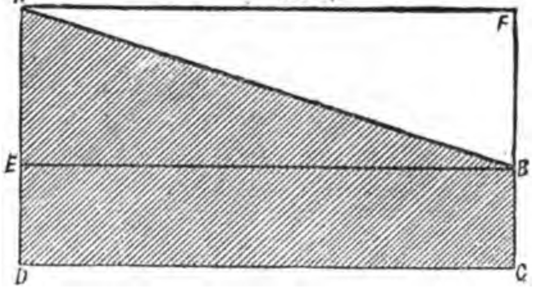


Had the area of A B E been made equal to the area of B C D E, and the one subtracted from the other, very little would have been left; such a diagram would represent the action of the oscillating masses; this shows that they produce very little extra friction. When the connecting rod is shortened as much as ¾ the length of stroke, this friction will only amount to as much as would be due to a parallel diagram, of which the height represents ·023 of the greatest pressure exerted by such masses, so that they may safely be neglected. The same is nearly the case with the weights of piston, rods, and shafting; as long as the up and down pressure on the piston is greater than these combined weights they will have no effect, because they only increase the load during the down stroke, and diminish it during the up stroke; but as soon as it grows smaller than the weights, they alone produce the friction, and the steam pressure only alters the distribution during the up and down stroke; this will, perhaps, explain the reason why some engines, especially land engines, lose comparatively more when running light than when loaded. If, however, the engines work horizontally, the weight of part of the connecting and piston rod will either constantly increase or diminish the friction, which depends on whether the crosshead is working on its lower or upper surface. The crank pin friction will also be increased by an amount which is probably a little less than that due to half the weight of the connecting rod, but can only be worked out for special cases. In double and treble engines the friction of the journals is slightly reduced, for it appears that in non-expansive engines with two cranks at right angles, the loads on them balance each other during two quarters of each revolution; in treble engines two cranks are always balanced, and it is therefore probable that in the former case a part (depending on the position of the journals) of one-half of the friction, and in the latter a part of two-thirds of the friction is saved. The following examples will still further explain the Tables, while showing to what use they may be put. The dimensions of one of these engines are taken from the supplement to Burgh's "Modern Marine Engineering," those of the other from *Engineering*, vol. xxi. p. 129, exemplifying two extreme cases of engine proportions. As regards the size of crank shaft in relation to the stroke, I have assumed the friction to be $\frac{1}{30}$ of the load, and have worked it out for two cut-offs in each case, with the following result:—

Ship's Name	Tug *Filga*, Fig. 5.		*Bell Bird*, Fig. 6.	
Piston Stroke... ...	12 in.		12 in.	
Connecting Rod ...	24 ,,		28 ,,	
Diameter of Crank pins	7 ,,		2½ ,,	
$l : S$	2		2⅓ ,,	
$\frac{d_2 + d_3}{2s}$	1 1·71		1 4 8	
Mean Pressure ...	·847	·50	·847	·50
Guide Friction : I.H.P.	·0103	·0093	·0083	·0071
Crank Friction : I.H.P.	·0903	·0996	·0180	·0177
Total Friction : I.H.P.	·1006	·1089	·0263	·0254

In the case of the tug *Filga* the friction is about four times greater than in the other boat. You will see that the chief reason is the very short stroke and large crank pin; it therefore is probable that the friction might have been considerably reduced if the height of engine and length of the stroke had been increased a little, unless this would increase the gland and piston friction, so that possibly the total loss would have been greater instead of less; but putting that aside and assuming that there was no room for heightening the engine, then the stroke could with slight advantage have been lengthened at the expense of the connecting rod.

Fig. 4.



The following numbers will show that the engine might have been improved, but only slightly:—

Stroke	12 in.	13·5	14·6	15·5
Connecting rod...	24 ,,	20·25	17·5	15·5
Diameter of Pin	7	7	7	7
$l : S$	2	1·5	1·2	1·0
$\frac{d_2 + d_3}{s}$	1 : 1·71	1 : 1·93	1 : 2·10	1 : 2 20
Mean Pressure...	·50	·50	·50	·50
Total Friction ...	·1089	·1023	·1011	·1013

So that as far as this friction is concerned, a stroke of 14·6 inches, with a connecting rod of 17·5 inches, will give the best results; but then the engines would not work so uniform as they now probably do, which will be seen later on. If, however, the above proportions are the most advantageous that can be adopted, such engines will never compare favourably with ordinary ones, especially as the chief friction is to be found in the bottom ends, where nobody wants it.

Returning now to the Diagrams I. and II., it will be seen that the crank-pin friction is least for an engine cutting off at about half-stroke with an infinitely long connecting rod, and that even when it is about twice as long as the stroke, which is now the general practice, the friction is less than it would be with a full diagram and a long rod. So long as the cut-off is kept above $\frac{3}{10}$, and the connecting-rods are longer than $\frac{3}{2}$ of stroke, there is little extra friction to contend with, either in single, double, or treble engines; the guide friction will also be comparatively small if those limits are not overstepped, though the length of the connecting rods has here a far greater influence.

Before referring to the uniformity of motion of engines, I shall have to draw your attention to the oscillating masses, and their influence on it.

All oscillating masses store up energy at the commencement of the stroke and redeliver it at the end; if there are other which just then are absorbing energy it will not be visible in the diagrams of the turning movement of the crank, and for such cases only a coefficient expressing the necessary inertia of a fly-wheel will be of value, while in other cases, where these masses can of course vary within wide ranges, just as the stroke and cut-off have been made to vary, the determination of such a coefficient would be very complicated and would require enormous tables, and even then they would only be valuable in so far as they could show some general law. Retaining, then, all the previous notations, the downward piston speed would be—

$$\frac{du}{at} = \frac{du.da}{da.dt} = r \sin a . \omega.$$

the downward acceleration is

$$\frac{d^2u}{dt^2} = r\omega \frac{d(\sin a)}{dt} = r\omega^2 \cos a,$$

and the force which the accelerated mass m of piston and rods exerts is

$$m \frac{d^2u}{dt^2}$$

producing a negative turning moment

$$M = -m r^2 \frac{\omega^2}{2} \sin 2a.$$

In an engine with two cranks at right angles this value would be—

$$M = -\frac{r^2\omega^2}{2} \sin 2a (m_1 - m_2).$$

If the moment of inertia I_1 of the connecting rod, taking its top end as fulcrum, be substituted for m_2, the turning moment produced in a single engine will be—

$$M_1 = -\frac{r^2\omega^2}{2} \sin 2a \left(m_1 - \frac{I_1}{l^2}\right).$$

$$\text{Double Engine } M_{II} = -\frac{r^2\omega^2}{2} \sin 2a \left(m_1 - m_2 - \frac{I + I_2}{l^2}\right).$$

$$\text{Treble Engine } M_{III} = -\frac{r^2\omega^2}{2} \left[\sin 2a \left(m_1 - \frac{I_1}{} \frac{m_2 + m_3}{2} + \frac{I_2 + I_3}{2\,l^2}\right) - \cos 2a \sqrt{\frac{3}{4}} m_2 - m_3 + \frac{I_3 - I_2}{l^2}\Big)\right].$$

If, however, the weights in the double and in the treble engines are equal, both M_{II} and M_{III} will equal nil, that is, the oscillating masses may be neglected in such engines when inquiring into the uniformity of motion. However, when these weights exert no disturbing influence on the turning moments they act as fly-wheels would do, and as the effect is very simple, and as I have never seen them looked at in this light before, I hope a short development of the principle will not be out of place.

(*To be continued.*)

"CITY OF ROME."—The Inman liner, *City of Rome*, 8,500 tons, will be launched at Barrow on June 14.

THE "POLYPHEMUS."—Preparations are now being made at Chatham Dockyard for the launch of the armour-plated torpedo ram, *Polyphemus*, which is to take place on June 15.

EARLY on the morning of May 17th, the steamship *Queen of the Bay*, bound from Penzance to Scilly, broke her shaft during strong weather off the Rundle Stone. Sails were hoisted with all speed, the crew being assisted by twenty fishermen who were on board. This was done only in time to prevent a disaster, for the head of the steamer was got round so close to the Rundle Stone that the buoy marking its proximity was touched.

REPAIRING A BROKEN CRANK WITH WIRE ROPE.

THE following description of the temporary repairs made to the broken cranks of the U.S. steamer *Pensacola* by G. W. Stivers, Passed Assistant Engineer U.S. Navy, is interesting in showing what may be done with wire rope in the way of repairs on shipboard.

The after crank of the forward engine only is shown, this one having been broken entirely across; but the plan adopted in banding both cranks of the after engine, which were broken nearly across, was precisely the same. The crank shaft and cranks were in one solid forging, and the fractures were directly across the bodies of the cranks, between the crank pins and the shaft, as if following the plane of contact of the fagots used in building up the cranks in the smithery.

For several months the existence of a very slight crack in the after crank of the forward engine was known, but frequent examinations failed to show any extension, and it was considered simply a surface flaw of no great consequence.

At about 5 p.m., June 18th, 1880, the ship being on her way from San Francisco to Puget Sound it was found that this crack was rapidly extending. The weather was fine, sea smooth, and with square sails set the engines were slowed down, while preparations were made to strengthen the crank by temporary bands, so as to reach Victoria, were it was expected that a heavy band could be forged and shrunk on. The only iron that could be worked on board ship was a piece 3⅛ in. wide and ¾ in. thick, and it was proposed to make of this two bands, to embrace the crank side by side and to be set up by two 1-in. bolts on each side, passing through lugs formed by bending up and thickening the ends. The strength of the bands as straps was therefore only that of two 1-in. bolts, and its utter insufficiency was evident.

At about 9 o'clock that night the crank had broken entirely across, but as the two parts moved together as usual, the irregular surfaces of the break and the long forward journal preventing their separation, the engines were kept slowly revolving until noon of the next day, when the plan of iron bands was abandoned, before being carried out in favour of the following one, proposed by Mr. Stivers.

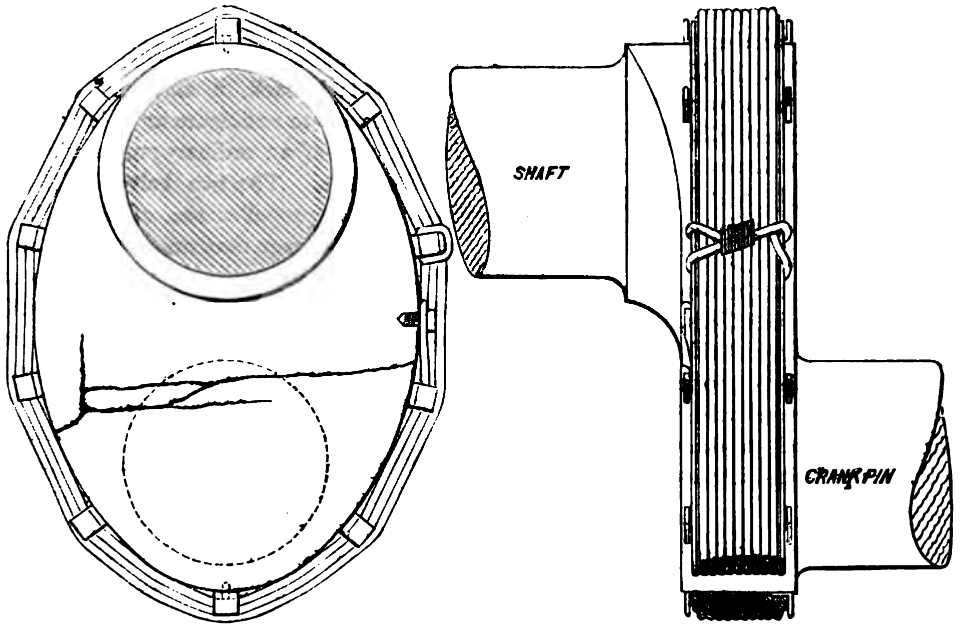
Ten gutter pieces or shoes were made of an old iron grating and placed equidistant about the crank in order to keep the bottom turns of wire rope from spreading apart when the riding turns came to be put on over them. The shoe at the extreme end and that on the butt of the crank only were secured in place by a small bolt through the centre, the other shoes being held in proper position by hand until bound by the first turn or two of rope. Into the hub of the crank a bolt one inch in diameter was tapped, to which the end of the rope was secured, and the work of wrapping the crank consisted simply in passing the wire rope continuously around the crank, hauling each turn taut by means of a heavy deck tackle passing down through the engine room hatch, and seizing each turn securely to the one immediately preceding it before slacking off the tackle. It was estimated that a tightening pull of about two tons was brought on each turn of rope, and the seizing of the separate turns having been done very expertly there was no slacking back of the wire rope during the progress of the whole work.

In this manner eleven turns of the rope were put around the crank side by side, just filling up the space between the jaws of the shoes; then over these were put ten riding turns, and over these again nine riding turns, making altogether thirty turns of wire rope encircling the crank. The finishing end was simply passed around the banding at one of the shoes and stopped, as shown in the sketch.

The wire rope used in this work was of $\frac{9}{16}$ inch diameter, consisting of five strands of 17 wires each, arranged about a central hemp core of inch $\frac{3}{16}$ diameter, the wires being of number 19 wire gauge.

The work of banding this crank was completed in seven hours, and just as it was finished it was found that both the cranks of the after engine were broken nearly across, the cracks extending entirely through each crank to within about one inch of each side, in about the same direction and relative position as in the forward crank. This discovery caused the abandonment of the attempt to reach Victoria; the ship was headed to the southward, with the intention of returning as best we could to San Francisco under sail, and, the banding of the forward crank having been so satisfactorily accomplished, it was decided to strengthen the after cranks in the same manner, so that the engines might be used in case of emergency.

This was done, and when about 200 miles from San Francisco, the wind blowing lightly from ahead, and sails being useless, the engines were started and worked continuously without stopping



REPAIRING A BROKEN CRANK WITH WIRE ROPE.

for over 45 hours, until the anchor was dropped in the harbour of San Francisco. During this time 45,835 revolutions were made, an average of 16·85 revolutions per minute, and an average speed made of 4·41 knots per hour under steam alone. The next day the ship was steamed up to the Mare Island Navy Yard, 26 miles from San Francisco, the engines being stopped and started seventeen times during the run to allow target practice, and upon arrival at the yard the rope banding was found to be as firm and unyielding as when first put on the cranks.

The speed at which the engines were run with these fractured cranks was low, for the weather was fine and no necessity required the taking of the least risk; the initial pressure above zero on the pistons was 20 pounds, cutting off at 9 inches, there being two cylinders, 60 in. diameter and 36 in. stroke; yet it is evident from a calculation of the strength of the banding on the extreme after crank, which transmits the power of both engines, and which would have been further strengthened if more wire rope had been at hand, that a considerably greater speed could have been safely attained.

The gutter pieces or shoes were, it will be seen, indispensable to the successful application of the wire rope banding, for they prevented the first course of rope from spreading under the pressure of the riding turns; they allowed the driving of iron wedges beneath them without injury to the rope, in case it should become slack and require tightening, and they permitted the passing of the end of the rope between the crank and the whole banding so as to secure it firmly.

It was expected that the wire rope would in a short time stretch, and the intention was therefore to first drive iron wedges under each shoe, nipping the ends over the end of the crank, and then to drive all around, under the rope banding, dry pine wedges which would be swelled by the water used on the crank pins, but there was no necessity for any wedging whatever, and perhaps would not have been had the engines been in operation a much longer time than they were. The shape of these cranks made the application of the banding quite a simple matter, though it would not be difficult to adopt such a system of wrapping with wire rope to a crank of any shape whatever.

It is thought that the idea has not occurred to engineers generally that they have in wire rope such a ready and effective means of temporarily repairing damages to engines at sea. Many repairs that are now made with straps or bands hastily constructed under the disadvantages always attending smith's work on board ship can be much more quickly and easily made by a few turns of wire rope. This material may yet be the means of repairing a broken shaft of a steamer so that she will be able to steam into port at a moderate rate of speed.

In the case of repairs to a broken shaft the ends of the rope could be passed through and secured to the back of square pieces fitted into keyways cut in the shaft, then passing the rope around the broken shaft and securing the other end of the rope in a like manner; these pieces to be bolted to the shaft with tap bolts; for backing the rope must be wound around the shaft in the opposite direction.

The ease and facility with which repairs can be made with wire rope commend it to engineers and steamship owners as a part of the necessary outfit for a steamship. J. C. Kafer.

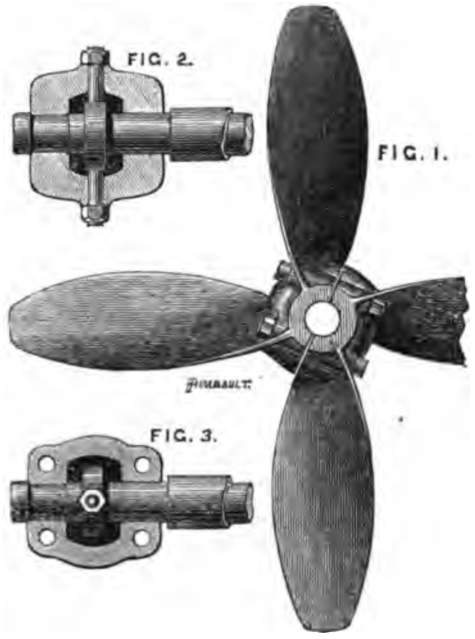
The Palmer Shipbuilding and Iron Company, at Jarrow, are now laying down the first of two very large iron screw steamers for Messrs. Leyland, of Liverpool. The steamers will measure 430 ft. in length by 40½ ft. in breadth and 20½ ft. in depth. They will be the largest vessels ever built in the Tyne.

Naval Exhibition.—The Shipwrights' Company have issued a public invitation to the ingenious of all nations to contribute to a competitive exhibition to be held in Fishmongers' Hall, in June, 1882, of models and designs of every sort of floating craft, from fishing smacks and torpedo launches to clipper-built schooners and stately vessels of war.

Mr. Robert Harrowing, of the firm of Messrs. Robert Harrowing & Co., steamship owners, Whitby, has contracted with Messrs. John Redhead & Co., of South Shields, for the construction of four large steamers of 2,100 tons each deadweight carrying capacity, which will be ready to take their places in Messrs. Harrowing & Co.'s large fleet by the commencement of 1882.

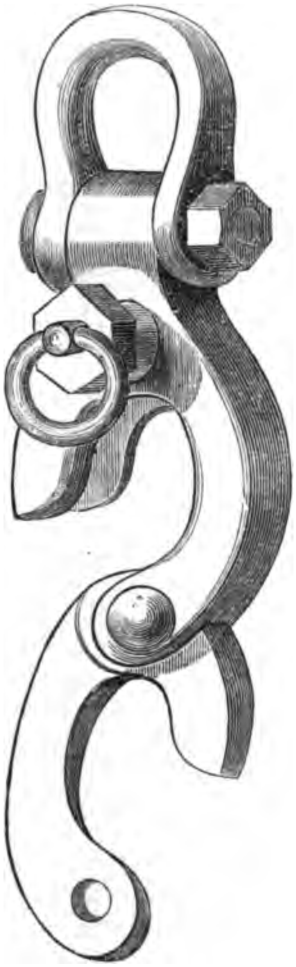
COOKE & MYLCHREEST'S SPLIT BOSS SCREW PROPELLER.

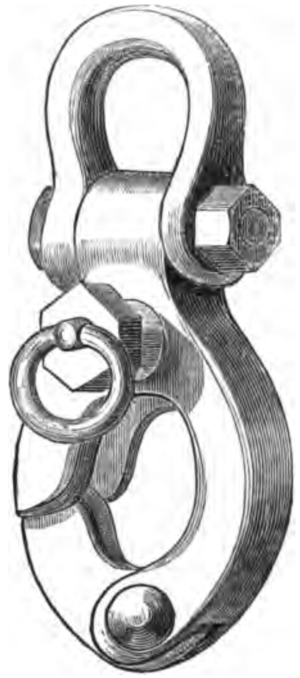
We subjoin an illustration ot the "split boss" screw propeller lately patented by Messrs. Cooke and Mylchreest. The invention is a very simple one, and considering the convenience attending it, it is singular that it should not have been introduced earlier. The essential feature consists simply in making the propeller in two halves, which are bolted together so as to clip the shaft. Referring to the engravings it will be seen that in the propeller, shown by Fig. 1, the two parts are simply held together by four bolts, while Figs. 2 and 3 show a modified arrangement specially suitable for propellers of large size. In the case of large propellers it would be inconvenient that both halves should be set free from the shaft together on removal of the connecting bolts, and to get over this a ring bolt A is provided, in addition to the four main bolts already mentioned. The centre part of this ring bolt is a good fit on the shaft, but is not keyed to the latter or fixed in any way, while the ends are each screwed for a nut. It will be seen that, by means of this ring bolt, the two parts of the propeller will be held on the shaft after the main bolts have been removed, and each part can be taken off separately at pleasure. There is, of course, no occasion to make the shaft tapered where it fits the screw, but it is collared at the end, and this prevents the screw from working back or off the shaft. In a propeller 14 feet 6 inches in diameter, with four blades, which the patentees have recently fitted to the new steamer, *Aristides* (2,300 tons), they have produced four main bolts, 4¾ inches in diameter, and a ring bolt with end, 3½ inches in diameter, so that a very strong connection is obtained, the intention being to provide a connection with a strength materially in excess of that of the propeller itself at the roots of the blades. As regards any tendency of the nuts to slack back, it may be said that there is no more reason to anticipate trouble from this cause than in the case of an ordinary propeller with blades bolted to the boss. The two halves of Messrs. Cooke & Mylchreest's propeller are, of course, much more convenient for stowage than an ordinary spare propeller, and altogether the arrangement promises to be a very useful one. Its chief advantages may be briefly summed up as follows:—Increased facilities in overhauling the propeller when needful, and a corresponding decrease of expenses, dock charges, and last, but not least, the great reduction of time in detention of the vessel; small space for stowage of spare propeller, it being in halves. Again, the castings are, for the same reason, much sounder than when cast whole, and the actual cost of manufacture of the propeller is considerably less than when cast whole. The royalty for the use of this patent is charged on each vessel using it, and not on the propeller itself, so that a steamer once licensed, no future charge is made for additional screw propellers supplied. Mr. John Hayes, of 27, Leadenhall Street, E.C., is introducing this propeller, and at the present time he has some large propellers in hand for steamers at Barrow, Sunderland, Cardiff, and other ports, and although, like most new improvements, it is being taken up somewhat cautiously by the shipping interest, still we think we are not far wrong when we say that it is decidedly a step in the right direction.



MORRIS & BENNETT'S PATENT SAFETY BOAT-LOWERING APPARATUS.

In our April issue we described and illustrated a boat-lowering contrivance, the property of the British and Foreign Boat-Lowering Company, Limited; and as every invention of a practical nature, bearing upon the important subject of saving life at sea cannot be brought forward too prominently in order that ship-owners may have every opportunity afforded them of being well-informed on this head, we have now pleasure in noticing the invention of Messrs. Conway, Morris & Bennett, Engineers, &c., 175, Blackfriars Road, London. We should state that the illustrations given refer to only one of *several* applications of a series of British and Foreign Patents taken out by the Firm named, for useful and ingenious disengaging, releasing, and "slipping" contrivances. It is only our province, however, to deal with that particular application which is of *direct* interest to our readers, as shown in the accompanying wood-cuts; viz., for lowering boats; Fig. 1 showing the "slip," disengaged or open, and Fig. 2 showing it shut. Its construction and action are as follows:—





The frame of the "slip" consists, as shown, of two sides or members, one of which is shorter than the other; the shorter side being slotted right through, and the longer side is recessed. The moveable or locking part is pivotted as shown, at the end of the longer side of the framing. It will be noticed that the end of the locking or moveable part of the "slip" is formed with an eye, which, on the "slip" being locked, takes into a spring locking and unlocking bolt or pin, with ring-releasing attachment at the head of the "slip" as shown, and which, when locked, will bear with safety a very considerable weight or strain upon it, while, on the other hand, on pulling the spring bolt, the weight or strain is immediately released. To facilitate the instantaneous action of the apparatus, the centre of the pivot at the lower end is slightly out of the line of the centre of the releasing spring pin or bolt. In applying the invention for boat-lowering, a pair of such "slips" are employed, and which may either be attached to the falls of the davits, or they may be fixed to the boat itself fore and aft, and, by means of a simple lever arrangement, a simultaneous release is effected.

Some experiments recently conducted in the East India Docks, at the request of Messrs. Shaw, Savill, & Co., resulted in showing the extreme simplicity and reliability of the contrivance, even when applied under considerable disadvantages as regards the existing tackle.

Messrs. Morris & Bennett's apparatus is *not*, it will be noticed, *automatic* in its action; and, though we are aware an automatic system of boat lowering has been recommended in certain quarters, we believe that, on due consideration, it will be found there are some fatal objections to be urged against its adoption. We may instance the liability of a boat to be released *before* it has been occupied, in the case of disaster, by the action of the waves in a heavy sea. Whereas, by the invention under notice the boat may be released at any desired moment with perfect safety, and by a simultaneous "slip."

ON STRENGTH OF CRANK SHAFTS.

BY J. T. MILTON, ESQ., Assistant Chief Engineer, Surveyor to Lloyd's Register; Member.*

AT the meetings of this Institution in 1879 I had the honour to read a Paper "On Some of the Causes of the Failure of Crank Shafts," in which it was shown that the bending moment produces a very considerable portion of the strain on crank shafts, even when all the bearings are in line; whilst if the bearings are allowed to get out of line the bending moment produces a very considerable increase of strain, a strain, in fact, very much greater than that due to the twisting moment. This was illustrated by a series of curves showing for five different types of engines the strains on each bearing for any position of the cranks, both when the bearings were lineable and also when one or other of the bearings was removed, a condition which I pointed out as being equivalent to the limit of unlineability likely to take place, and one which is by no means unlikely to occur in practice every time a bearing is allowed to become heated.

These diagrams showed that, with the engine in good working order, the second and third journals from forward have each to transmit the twisting moment of the forward engine, and have also to withstand a small bending moment; the fourth journal has to transmit the combined twisting moment of the two engines, whilst the after crank-pin has to bear a considerable bending moment in addition to a twisting moment, and is therefore in general the most strained part of the shaft.

When one of the centre bearings is taken away, the greatest strain comes upon the adjacent crank-pin, but the greatest strains coming on the shaft are produced on the second bearing when the first is slacked back, and on the third bearing when the fourth is slacked back.

Thus in engine B, in which the cranks are at 90°, it is seen that with the second bearing slack the strain on the shaft becomes increased to 1·57 times its original amount, while with the first bearing slacked, the strain is increased 2·29 times. In engine C, with cranks also at 90°, the increase of strain is 1·60 and 2·24 times in the two cases, but in engine D, with cranks at 130°, the increase is not so marked, it being only 1·11 and 1·53.

In the present paper I wish to lay before you the effect produced on the strains on the shafting by variations in the angles between the cranks, and also by a variation in the length of the stroke.

For this purpose I have taken the indicator diagrams of a pair of engines with cylinders of 30 and 60 inches diameter and 39 inches stroke, worked at a boiler pressure of 85 lbs. per square inch. They are of recent construction, and are a very well-designed and efficient pair of engines. From the diagrams the crank pin pressures have been ascertained, allowance being made for the effect of the inertia and weight of the reciprocating parts, and the strains on the shafting have been calculated for every 20° of the revolutions of the engines in ten cases, the angles between the cranks varying from 90° to 180°. The results of the maximum strains are given in Table I. The similar strains occurring in the engine on the supposition of the stroke being increased to 60 inches have also been calculated, and the results are given in Table II. The twisting moment is increased proportionately to the length of stroke, but the bending moment remains unaltered. In each case I have calculated the amount of the increased strain due to slacking back the bearing as well as the strains caused by the ordinary working, in the same manner as was done in the previous paper, as it is important in designing any structure to provide for any abnormal strain likely to come upon it as well as for the strains due to ordinary working.

In Fig. 1 are seen the twisting moments on the supposition of the cranks being set at the various angles from 90° to 180°; the dotted line represents the mean twisting moment, and the upper black line the combined moment at the different parts of the revolution. From these diagrams it is seen that the least twisting strain comes when the angles of the crank are at 90°; gradually increasing with the increase of the angle between the cranks until at 180° it reaches its maximum of 35 per cent. in excess of that at 90°. It is to be remarked that the ratio of the maximum moment to the mean, viz., $\frac{1\cdot31}{1}$ in this engine, even when the cranks are at 90°, is much greater than it is usually thought to be, and in a large number of cases, when the inertia and the obliquity of the connecting rod are taken into account, I have rarely found the r fall below $\frac{25\cdot}{1}$

In Fig. 2 will be seen representations of the bending and ing moments on the after crank-pin which is the part of th most strained, they being represented by black lines, wh upper dotted line represents the stress caused by the twisti bending combined. From these diagrams it is seen that th on the crank shaft, unlike the twisting moment alone, is l this engine with the cranks at angles of 110°, while it is th at 140° as at 90°, and then increases as the angle increases, t but the increase is not nearly so great as in the case of the tw moment, being only 13 per cent. as compared with 35 per and comparing the strain on the crank-pin with that on shafting, we find that only at 90° and 100° is it much grea all the other angles the difference not exceeding 5 per cent.

Fig. 3 shows the strains on the second bearing on the supp of the first being slacked back. In this case the strain is pra the same for all angles of the crank.

Fig. 4 shows the strains coming on the third bearing wh fourth bearing is slacked back. From these diagrams it i that the greatest strain occurs in the case in which the cran at 90°, and the least when they are at from 150° to 180°; s In this case, which is practically the worst that can befall th those engines with cranks at larger angles have a decided adv over the one with cranks at 90°, especially if we compare th thus produced with the greatest strain coming on the crank s ordinary working, as shown in Fig. 2.

Taking now the case of the engine with the stroke increase 39 to 60 inches, the crank pin pressures remaining the sa find these results a little modified.

The twisting moments will still be represented by Fig. 1, l scale will be altered, and the ratio of maximum to mean tw moment will therefore be the same.

The strain on the aft crank pin is shown in Fig. 5, the low again representing the bending moment, and the dotted li stress caused by the twisting and bending combined. It w seen by comparison with Fig. 2 that this is much less in prop to the twisting moment than in the case of the shorter stro fact, it is only in the case of the engine with cranks at 90°, th strain on the aft pin exceeds that borne by the screw shaftin

In Fig. 6 is shown the strain on the second bearing c supposition that the first is taken away and as with Fig. 3 case of the short-stroke engine, this is practically the same at ever angle the cranks are inclined.

In Fig. 7 is shown the strains coming upon the third b when the fourth is slack, and, as in the case of the other e these are absolutely more when the cranks are at 90° than they are wider apart.

TABLE III.

Table showing the Ratio of the Strain in Engine B to the Engine A for the same Twisting Moment exerted.

Angle between Cranks.	After Crank Pin bearings lineabl	2nd bearing with 1st bearing slack	3rd bearing with 4th be ing slack.
90°	·86	·74	·70
100°	·86	·74	·71
110°	·95	·74	·68
120°	·94	·74	·68
130°	·93	·74	·68
140°	·94	·74	·67
150°	·90	·74	·66
160°	·90	·74	·65
170°	·90	·74	·66
180°	·90	·74	·67

(*Continued on page* 66.)

[NOTE.—Figs. 3 and 6, and Low and High Pressure Dia will appear in our next issue.—ED. M.E.]

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* [Read at the Twenty-second Session of the Institution of Naval Architects, 7th April, 1881; the Right Hon. the Earl of Ravensworth, President, in the Chair.]

TABLE I.

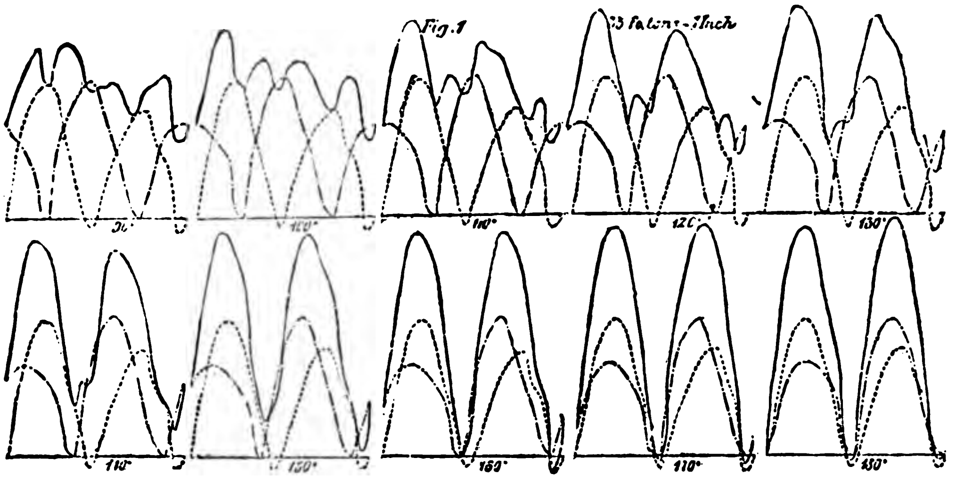
Diameter of Cylinders, 30 *and* 60 *in.; length of Stroke,* 39 *in.*

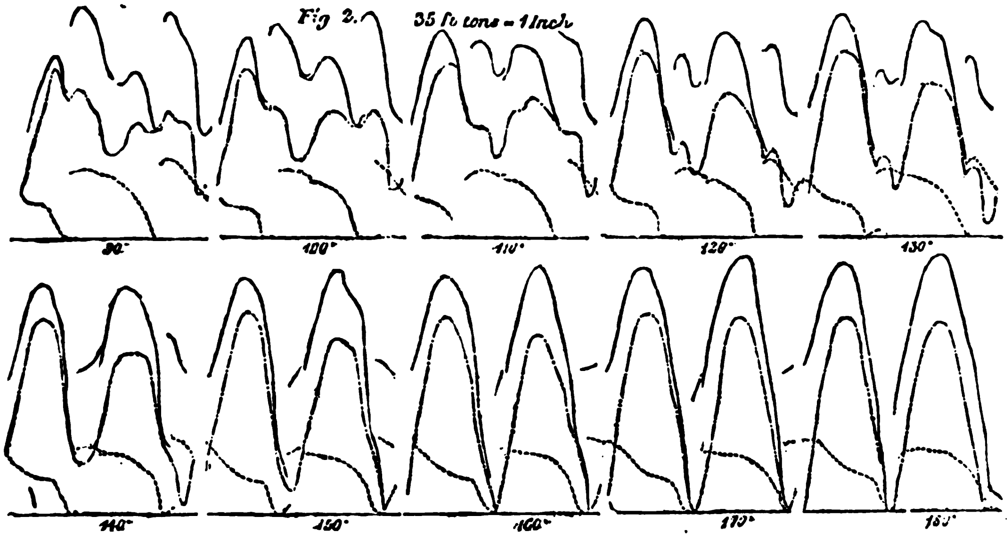
Angles between Cranks.	Ratio of Maximum Twisting Moment to Mean Twisting Moment.	Ratio of Maximum Twisting Moment to that with Cranks at 90°.	Ratio of Strain on Aft Crank Pin to that which would be produced by the Mean Twisting Moment.	Ratio of Maximum Strain on Aft Crank Pin to that on the Screw shafting	Ratio of Maximum Strain of Crank Shaft to that with Cranks at 90°.	Ratio of Strain on 2nd Bearing, with the 1st Bearing slack, to that which would be produced by the Mean Twisting Moment.	Ratio of Strain on 2nd Bearing, with the 1st bearing slack, to that on Aft Crank Pin when bearings are lineable.	Ratio of Strain on 3rd Bearing with the 4th Bearing slack, to that which would be produced by the Mean Twisting Moment.	Ratio of Strain on 3rd Bearing, with the 4th Bearing slack to that on Aft Crank Pin when Bearings are lineable.
90°	1·31	1·00	1·63	1·24	1·00	2·61 at all Angles.	1·60	2·90	1·77
100°	1·40	1·07	1·60	1·14	·98		1·63	2·87	1·79
110°	1·45	1·10	1·47	1·02	·90		1·78	2·82	1·92
120°	1·52	1·16	1·56	1·03	·96		1·67	2·77	1·77
130°	1·55	1·18	1·59	1·03	·97		1·64	2·75	1·73
140°	1·61	1·23	1·62	1·01	1·00		1·61	2·72	1·68
150°	1·66	1·27	1·73	1·04	1·06		1·51	2·66	1·54
160°	1·66	1·27	1·74	1·05	1·07		1·50	2·66	1·53
170°	1·72	1·31	1·81	1·05	1·11		1·44	2·67	1·47
180°	1·77	1·35	1·84	1·04	1·13		1·42	2·67	1·45

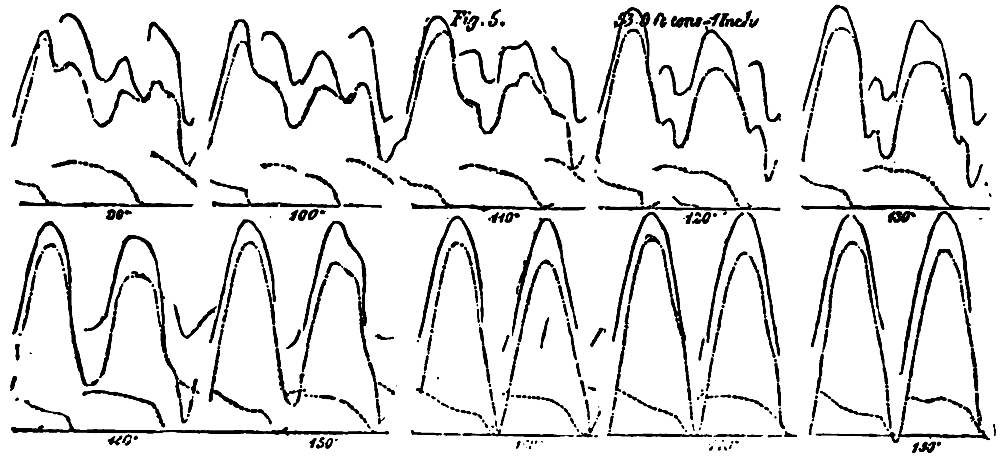
TABLE II.

Diameter of Cylinders, 30 *and* 60 *in.; length of Stroke,* 60 *in.*

Angles between Cranks.	Ratio of Maximum Twisting Moment to Mean Twisting Moment.	Ratio of Maximum Twisting Moment to that with Cranks at 90°.	Ratio of Strain on Aft Crank Pin to that which would be produced by the Mean Twisting Moment.	Ratio of Maximum Strain of Aft Crank Pin to that on the Screw shafting	Ratio of Maximum Strain of Crank Shaft to that with Cranks at 90°.	Ratio of Strain on 2nd Bearing, with the 1st Bearing slack, to that which would be produced by the Mean Twisting Moment.	Ratio of Strain on 2nd Bearing, with the 1st Bearing Slack to that on Aft Crank Pin when Bearings are lineable.	Ratio of Strain on 3rd Bearing, with the 4th Bearing slack, to that which would be produced by the Mean Twisting Moment.	Ratio of Strain on 3rd Bearing, with the 4th Bearing slack to that on Aft Crank Pin when Bearings are lineable.
90°	1·31	1·00	1·40	1·07	1·00	1·94 at all Angles.	1·81	2·04	1·46
100°	1·40	1·07	1·37	·98	·99		1·98	2·04	1·46
110°	1·45	1·10	1·40	·97	1·00		2·00	1·91	1·32
120°	1·52	1·16	1·46	·96	1·05		2·02	1·89	1·24
130°	1·55	1·18	1·48	·96	1·06		2·02	1·86	1·20
140°	1·61	1·23	1·52	·94	1·09		2·06	1·81	1·12
150°	1·66	1·27	1·55	·93	1·11		2·08	1·75	1·05
160°	1·66	1·27	1·57	·94	1·12		2·06	1·73	1·04
170°	1·72	1·31	1·62	·94	1·16		2·06	1·77	1·03
180°	1·77	1·35	1·65	·93	1·18		2·08	1·82	1·03







STRAINS ON CRANK SHAFTS.

Fig. 4.

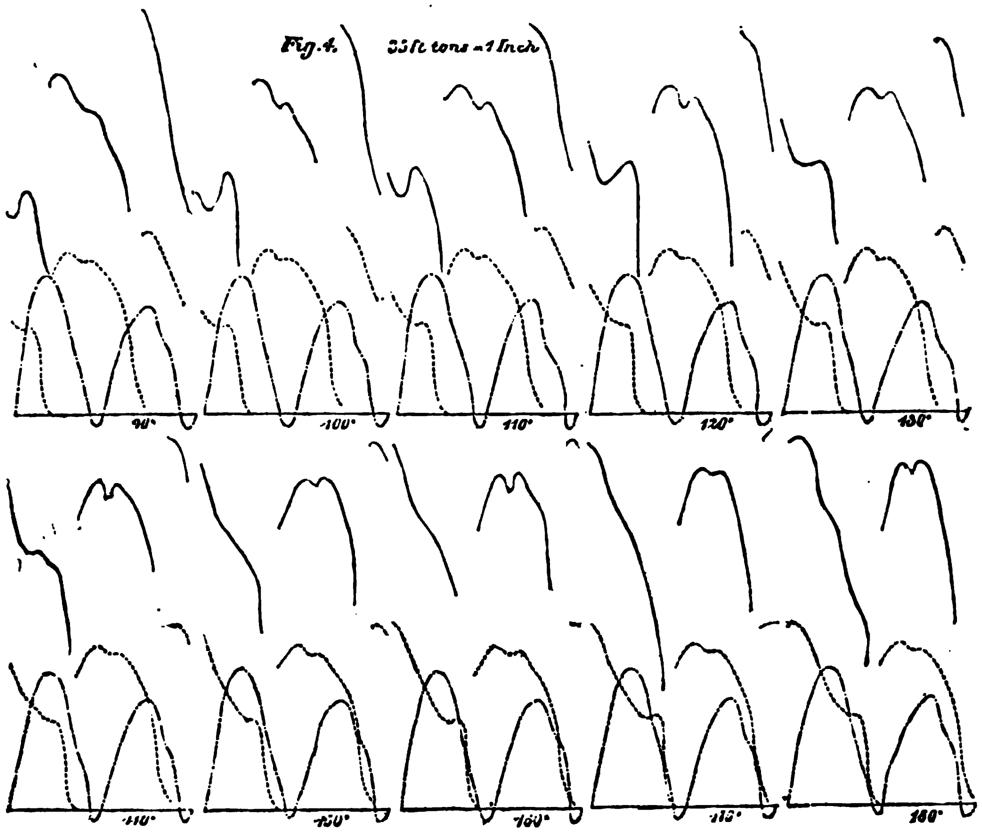
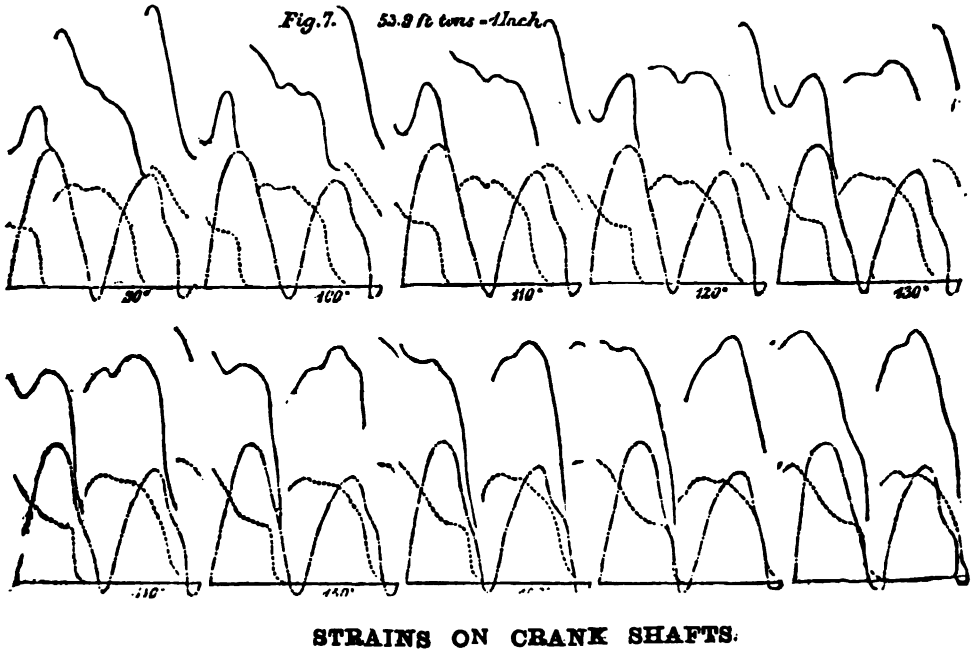


Fig. 7.



STRAINS ON CRANK SHAFTS.

From these diagrams it is seen that the extra strain thrown on the crank shaft by increasing the angle of the cranks beyond 90° is not so great proportionately as that thrown on the screw shafting, whilst the extra or undue strains thrown upon the crank shaft by any unlineability of the bearings is less in the engines with the cranks wide apart than in that with the cranks at 90°.

These diagrams also show very conclusively that in engines in which the strokes bear different proportions to the diameters of the cylinders, it is wrong to assume that the straining effect on the shafts varies as the twisting moment, it being seen in these two cases (*vide* Table III.), that with the same useful work done in the engine with the longer stroke, the crank shaft is only strained about nine-tenths as much as in the short-stroke engine, while in the extreme cases of the shaft being unevenly supported at the bearings, this proportion becomes still less.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Heron.—On April 16th Messrs. Scott & Co. launched from their building yard a handsomely-modelled iron screw-steamer, of 150 tons, built to the order of Messrs. R. Walker & Co., Clyde Terrace, Glasgow, and intended for the Loch Fyne herring trade. She will be fitted with compound surface-condensing engines of 45-horse power, by Messrs. R. Harvey & Co., Glasgow. As the vessel moved into the water she was named *Heron* by Mrs. Gibb, Granby Terrace, Glasgow.

Galileo.—On April 26th there was launched from Messrs. Earle's yard, Hull, a steamship for Messrs. Thomas Wilson, Sons, & Company, of Hull. As the vessel left the ways she was named the *Galileo*. She is the 61st ship built for Messrs. Wilson by Earle's Company, is intended to form an addition to the line of the Atlantic steamers, and is designed for the conveyance of cargo and cattle, the accommodation for which is very complete, the whole of the 'tween decks, a long turtle back forward and aft, and the bridge amidships being devoted to this purpose. The vessel will by this means be enabled to bring over an unusually large number of cattle, and will also carry 4,000 tons dead-weight. The accommodation for captain, officers, and a few passengers is provided under the bridge, the crew being berthed forward, under the upper deck. The vessel is built on the longitudinal system adopted in the ships of her Majesty's Navy, having a complete inner bottom, extending fore and aft. This feature gives additional safety in the event of striking the ground, as well as providing for water ballast, the arrangements for filling and discharging the ballast being of a very complete description. The length between perpendiculars is 350 ft.; her breadth, 41 ft.; and depth in hold, 27 ft. 6 in. She is brig rigged, and is built to class 20 years in the Liverpool Registry. She has long shelter decks at each end and amidships for the purpose of carrying and sheltering cattle on the upper deck, in addition to the usual accommodation between decks. The gross tonnage of the vessel is 3,500 tons. She is propelled by a pair of compound surface-condensing engines of 300 nominal horse power, the cylinders being 34 in. and 68 in. diameter by 63 in. stroke, and very similar in general design to those of the screw steamship *Romano.*

Oliveto.—On April 26th there was launched from Mr. Laing's yard at Deptford, an iron screw-steamer of the following dimensions:—Length over all, 300 ft.; breadth, 36 ft.; depth to awning deck, 27 ft. She will be fitted with Emerson & Walker's direct steam windlass, Higginson's "steam quartermaster," Clark, Chapman, & Gurney's steam winches, Colling & Pinkney's topsails, and engines of 180-horse power by Mr. George Clark, Southwick. This is the eleventh steamer built by Mr. Laing to the order of Messrs. G. D. Pinkney & Sons, and she is fitted with all the latest improvements in outfit, and is intended for the South American and Indian trades. As she left the ways she was christened the *Oliveto* by Miss F. Alcock, daughter of Mr. J. T. Alcock, J.P., of Newcastle.

Blaenavon.—On April 26th a screw-steamer was launched from Messrs. Palmer & Co.'s Howdon shipyard. This is the first vessel launched from this yard since its re-opening, and is of the following dimensions, viz.:—Length, 240 ft.; breadth of beam, 33 ft.; depth of hold, 16 ft. 6 in.; and is to be fitted up in the usual manner, with steam winches, windlasses, &c. She is classed 100 A 1 at Lloyd's, and has been built to the order of Morrell Brothers, Cardiff, and under the superintendence of Captain P. Gills, Cardiff. As she glided from the stocks she was named *Blaenavon*, by Miss Price, daughter of the general manager of Palmer & Co.'s shipyards. The *Blaenavon* is intended for the Bilbao trade.

Hermann.—On April 28th the Sunderland Shipbuilding Company (Limited) launched from their yard at the South Dock an iron screw-steamer of the following dimensions:—Length over all, 330 ft.; breadth, 40 ft.; depth to awning deck, 29 ft. 3 in. and is expected to carry 3,800 tons deadweight. She is classed 100 A 1 at Lloyd's, and has iron 'tween decks and wooden upper deck, water ballast, five bulkheads, four steam winches, Emerson & Walker's direct-acting steam windlass, Colling & Pinkney's topsails, Higginson's "steam quarter-master," and all other recent improvements. She has been built to the order of Messrs. D. G. Pinkney & Sons, but sold by them to some friends on the Continent, and will form one of the White Star Line of Steamers from Antwerp to New York, carrying emigrants and general cargo. The ceremony of naming the vessel the *Hermann* was performed by Miss Marion Pinkney, daughter of Mr. D. G. Pinkney.

Balaklava.—On April 28th Messrs. Osbourne, Graham, & Co. launched from their yard at Hylton an iron barque, built to the order of Messrs. Davison, Bisset, & Co., of Liverpool, of the following dimensions and particulars:—220-horse power, by 36 ft. 6 in. beam, by 22 ft. 6 in. deep; built with short full poop aft, containing accommodation for Captain and Officers and a few passengers: teak house amidships with galley and accommodation for petty officers and crew. The vessel will be classed 100 A1 at Lloyd's, and has been superintended during construction by Captain James Davison, who will command her. On leaving the ways the vessel was named the *Balaklava* by Mrs. Jas. Davison.

Ross-shire.—On April 30th Messrs. Edward Withy & Co. launched from Middleton shipyard, West Hartlepool, an iron screw steamer, built to the order of Messrs. Turnbull, Martin, & Co., of Glasgow, and under the inspection of Mr. J. Wotherspoon, of Port Glasgow. Her principal dimensions are:—Length, b.p., 285 ft.; beam, extreme, 36 ft.; depth moulded, 25 ft. 2 in. She is built to Lloyd's highest class as a three-decked cargo-boat, and has top-gallant forecastle and long bridge-house protecting the stokehole openings, three masts, the fore and main being of iron, four steam winches, and steam steering gear. Her main deck is of iron throughout, and she is constructed on the cellular double-bottom principle. She will be fitted with compound engines, working at 80 lbs pressure, by Messrs. Blair & Co. (Limited), of Stockton-on-Tees. The cylinders will be 34½ and 64 by 42 stroke. She is intended to be employed mostly in the general freight trade, and will carry 3,000 tons deadweight. As the steamer left the ways she was christened *Ross-shire* by Miss Marion Withy.

Dryburgh Abbey.—On April 30th there was launched from Messrs. Wigham Richardson's & Co.'s Neptune Works on the Tyne, a screw steamer, of 3,500 tons burthen; and as she left her berth she was christened the *Dryburgh Abbey*, by Miss Purves of Newhouse, Dunbar, This steamer has been specially designed for the Atlantic and Indian trades, and in her construction attention has been paid to her increasing requirement for the safe conveyance of live stock from America. Her dimensions are—300 ft. by 37 ft. by 27½ ft., and she will be fitted with engines, by her builders, of 1300 effective horse power. The boilers, three in number, embrace all the latest improvements for the consumption of any kind of coal. She has been built to the order of Messrs. Wood Brothers & Co., Liverpool, under the superintendence of Messrs. Ashlin & Asbridge, Liverpool, and will be commanded by Captain Forbes.

Moss Rose.—On April 30th there was launched from Messrs. Edward Finch & Co.'s (Limited) shipbuilding yard, at Chepstow, an iron screw tug steamer for Messrs. D. Guy & Sons, of the Bute Docks, Cardiff, of the following dimensions:—Length, 80 ft.; breadth, 15 ft. 6 in.; depth, 9 ft.; to be fitted with compound surface-condensing engines of 45 nominal-horse power, and to have a Board of Trade certificate for passengers. The vessel will have two cabins, fitted fore and aft with lifeboat, &c., for excursion purposes. She was christened the *Moss Rose* by Miss Ada May Guy, granddaughter of the senior partner of the Owner's firm.

Chateau Lafite.—On April 30th there was launched from the shipbuilding and engineering establishment of Messrs. Oswald, Mordaunt, & Co., at Southampton, a screw steamer for the Bordelaise Company, of Bordeaux, of which M. Lalande is president. The ceremony of naming the steamer was performed by Madame H. Bordet, of Bordeaux, and the steamer was named the *Chateau Lafite*. She will be under the command of Captain Billard. This steamer, which will take the highest class at Lloyd's, and is built in excess of their requirements for the class, is intended to run between Bordeaux and New York, and is the pioneer steamer of the company's fleet. Her dimensions are:—Length, 380 ft.; breadth, 41 ft. 6 in.; depth of hold to upper deck, 30 ft.; gross tonnage, about 3,800 tons. She has a forecastle and a bridge amidships; she has a saloon fitted up to accomodate 40 first-class passengers. Her engines, also by the same builders, are of the direct-acting compound inverted cylinder type, and are expected to indicate 2,400-horse power. The vessel is also fitted with steam steering gear amidships, steam windlass for lifting anchors, steam winches and cranes for rapid discharge of cargo, and all other modern improvements, She is expected to be ready for sea by the end of June next.

On May 11th, there was launched from the shipbuilding yard of Mr. George K. Smith, Newcastle-on-Tyne, a small screw steamer of the following dimensions:—Length, 52 ft., breadth, 11 ft., depth 6 ft. 6 in. This vessel was built to the order of Messrs. Dobeson & Wost, engineers, &c., Gateshead, where she was taken to receive her engines, and will afterwards be employed for towing.

On May 12th there was launched from the shipbuilding yard of Mr. George R. Smith, of Whitehill Point, North Shields, a small iron screw steamer of the following dimensions:—Length, 52 ft.; breadth, 11 ft.; depth, 6 ft. 6 in. She was built to the order of Messrs. Dobeson & Sons, Team Engine Works, where she is to receive her engines.

Muriel.—On May 12th Messrs. Hodgson & Soulsby launched from their building yard, at Blyth, an iron screw steamer named the *Muriel*, built to the order of Messrs. Sanders & Son, merchants, Colchester. Her dimensions are:—95 ft. long, 18 ft. 3 in. beam, and 7 ft. 6 in. depth. The steamer will be classed 90 A 1 at Lloyd's; she has an iron deck and water ballast, hatchway 30 ft. by 11 ft., and combings 2 ft. 3 in. high, with large hold for light goods. The dead weight cargo will be 140 tons on about 7 ft. She will have a powerful horizontal steam winch for working cargo, and also for working windlass for getting anchors, and will steer from a bridge in midships. She has been designed by R. Shead, Hythe Quay, Colchester, and he intends to run her between London, Colchester, and Mistley. She has compound engines by R. & W. Hawthorne, of Newcastle, and will be ready by the end of May.

Combermere.—On May 14th an iron sailing ship was launched from the building-yard of Messrs. Richardson, Duck & Co., South Stockton-on-Tees, of the following dimensions, viz.:—Length over all, 264 ft.; length between perpendiculars, 244 ft.; extreme breadth, 39 ft.; depth in hold, 24 ft. 3 in.; gross tonnage, about 1,724 tons; nett tonnage, 1,667 tons. She is classed 100 A 1 at Lloyd's and 20 years Liverpool, and has been built under special survey. The vessel has a full poop, for the accommodation of first-class passengers, Captain and Officers; a topgallant forecastle, and a deckhouse amidships for the crew, galley, &c. The ship has been built to the order of Messrs. C. W. Kellock & Co., Liverpool, under the inspection of Captain Cranston and Mr. Malcolm. As the vessel was leaving the ways she was christened the *Combermere* by Miss A. C. Richardson, of Newcastle-on-Tyne.

Akaba.—On May 14th, Messrs. M. Pearse & Co. launched from their iron shipbuilding yard, at Stockton-on-Tees, an iron screw steamer of the following dimensions:—Length between perpendiculars, 300 ft.; extreme breadth, 36 ft.; depth of hold to top of floors, 25 ft. 6 in. She will be about 2,300 tons gross register, and will class 100 A 1 at Lloyd's. She has full poop, long bridge, and topgallant forecastle, and is built on the three-decked rule with two decks laid, both being of iron, and will be rigged as a three-masted schooner, having double topsails on her foremast. She will be fitted with engines by Messrs. Blair & Co., of 280-horse power nominal, and have four steam winches and patent steam steering gear. She has double bottom for water ballast, and all the most recent and improved appliances for expeditiously loading and discharging. As she left the ways she was christened *Akaba* by Miss Florence Fowler,

Columbia.—On May 14th Messrs. W. H. Potter & Son launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, a new iron sailing vessel of the following dimensions, viz.:—Length, 279 ft.; beam, 39 ft.; depth in hold, 24 ft.; tonnage, B.M., 2,000 tons. The vessel was christened the *Columbia* by Mrs. Sandbach Parker. The *Columbia* has been built to the order of Messrs. Sandbach, Tinnie & Co., of Liverpool. She will receive Lloyd's and Liverpool Underwriters' highest class, but her scantling is considerably in excess of the requirements of both books. The *Columbia* will shortly be placed on the loading berth for Calcutta, and will be commanded by Captain W. H. Angel, formerly of the *Sheila*.

Macedonia.—On May 14th Messrs. William Gray & Co., launched from their yard at West Hartlepool, an iron screw steamer of the following dimensions:—Length, 256 ft. 6 in.; breadth, 34 ft. 6 in.; depth in hold, 19 ft. 8 in., to the order of William Gray, Esq., West Hartlepool. This vessel is intended for the American, Mediterranean, or Indian trades, is 1,750 tons register, and fitted with engines of 140-horse power, constructed by Messrs. Blair & Co., (Limited), Stockton; she has also four steam winches by Clark, Chapman & Co., and patent windlass by Emerson & Walker. On leaving the ways the ceremony of christening was performed by Mrs. Gray, and the vessel named *Macedonia*.

Anjer Head.—On May 14th, Mrs. Raylton, Dixon & Co. launched from their Cleveland Dockyard, Middlesbrough, the above-named steamer. The christening ceremony was performed by Miss Mary Lennard, daughter of J. M. Lennard, Esq., of Middlesbrough. The *Anjer Head* is 286 ft. long over all, 36 ft. broad, and 24½ ft. in depth, and will carry about 2,900 tons deadweight, or 3,500 tons measurement. Her engines, by Messrs. T. Richardson & Sons, of Hartlepool, are expected to develope about 1,200-horse power effective. All the arrangements of the steamer for working cargo are most complete, and her outfit comprises all the newest improvements.

Harvest.—On May 14th an iron screw steamer, built to the order of Messrs. English, Smurthwaite & Co., of West Hartlepool, was launched from Messrs. Irvine & Co.'s shipyard. Her dimensions are as follows:—245 ft. in length, 33 ft. in breadth, and 17 ft. 9 in. depth of hold. She is constructed to carry 2,000 tons deadweight. She is built on the cellular bottom principle, and is fitted with three steam winches and other appliances suitable for the general trade. The engines, of 130-horse power, will be supplied by Messrs. Thomas Richardson & Son, of Middleton Iron Works. As she left the ways the vessel was christened the *Harvest* by Miss English.

Talabot.—On May 14th Messrs. Schlesinger, Davis & Co. launched from their building-yard at Wallsend an Iron screw steamer, named *Talabot*, for La Société Française des Steamers de l'Ouest, Mesnier & Co., of Havre and Swansea. This vessel, which measures as follows—245 ft. between perpendiculars, 33 ft. broad, and 16½ ft. depth of hold—classes 100 A 1 at Lloyd's, has been built under the special inspection of Lloyd's and the owner's surveyors, and will carry large cargoes on a light draught of water. Being intended principally for the coal trade, she is constructed with Price's self-trimming hatches for saving both time and expense in loading. She will be fitted with steam windlass, Harrison's patent steam steering gear; steam winches at each hatch, and every requisite on deck. The cabins are amidships, and will be fitted with every convenience. The engines are being constructed by Messrs. R. & W. Hawthorn, of Newcastle, and the cylinders are 38 in. and 58 in. diameter, with a stroke of piston in both of 36 in. The christening ceremony was performed by Miss Ida Davis.

Ethel Horatio.—On May 16th Messrs. Osbourne, Graham, & Co. launched from their yard at Hylton an iron screw steamer, built to the order of a local firm, the third by the builders for the same firm. The dimensions of the vessel are 225 ft. long, 32½ ft. beam, and 16 ft. 6 in. deep, and she is built with long raised quarter deck, bridge house, and topgallant forecastle, large hatches of the "Step" pattern, and will be fitted with three steam winches and all facilities for rapid loading and discharging, and compound engines by Messrs. Hawks, Crawshay & Sons, of Gateshead, with cylinders 28 in. and 54 in. and 36 in. stroke. On leaving the ways she was named the *Ethel Horatio*, by Mrs. J. F. Marshall.

Kent.—There was launched on May 16th, from the Wear Dockyard, Sunderland, by Messrs. S. P. Austin & Son, an iron screw steamer, named the *Kent*, of about 1,020 tons gross register, specially designed for the ore and coal trades to carry a large cargo, on light draught of water, at a high rate of speed. She has been built under special survey to class 100 A 1 at Lloyd's, and will be completed in detail similar to the *Medway*, constructed at the same establishment for the same owners, Messrs. Lambert Bros, London.

Darien (s).—On May 17th a screw steamer, built to the order of Messrs. Nelson, Donkin, & Co., of Newcastle, was launched from the Jarrow Yard of Messrs. Palmer & Co. Her dimensions are:—Length, 328 ft.; breadth of beam, 39 ft.; depth of hold, 26 ft. 9 in. She will have three decks, two of which will be of iron, and will be fitted with water ballast in the bottom and in a deep tank, which can also serve for cargo in the hold. She will be rigged as a three-masted schooner, and her carrying capacity will be 3,600 tons deadweight. She is intended for general trade, and is named the *Darien*.

Acacia (s).—On May 17th Messrs. Short Bros. launched from their Pallion Yard, Sunderland, a steamer, to the order of Messrs, Coatsworth, Stockdale, & Co., Sunderland. Dimensions:—Length over all, 270 ft.; breadth, 36 ft.; depth, 19 ft. 6 in.; with engines of 180-horse power, by Mr. John Dickenson. As she left the ways she was named the *Acacia* by Mrs. Stockdale.

Pelham.—On May 18th a steamer, named the *Pelham*, was launched from the shipbuilding-yard of Messrs. Hodgson & Soulsby, Cowpen Quay, Blyth. The steamer, which is fitted with all modern improvements, is intended for the coasting trade, having been specially built to the order of a firm of merchants in Newcastle.

LAUNCHES.—Scotch.

Carmona.—On April 28th, in presence of a very large crowd, Messrs. Gourlay Brothers & Company launched the largest vessel ever built at Dundee. She is to the order of Messrs. W. Thomson and others, and will be commanded by Capt. Halcrow, presently of the *Avlona*, belonging to the same owners. She is an iron screw-steamer, registering 3,800 tons gross, and her dimensions are:—Length, 350 ft.; breadth moulded, 42 ft. 6 in.; depth of hold, 33 ft. 6 in. Her class is 100 A in Lloyd's Register. Among the prominent features in construction are the following:—She has three iron decks, three holds, and five watertight bulkheads. Besides, she is provided with a double bottom on the Bracket system; the space between the two bottoms being used as water ballast tanks. A turtle or whale's back to protect the vessel in a seaway is built over the forecastle, and there is a house aft covering the steering gear. Steam steering appliances are situated amidships in addition to hand steering gear aft. For lifting the anchor Emerson & Walker's steam windlass is introduced. The vessel will be rigged as a three-masted schooner, and will carry five boats. She will be fitted with compound surface-condensing engines of 380-horse power nominal. The high pressure cylinder is 42 in. in diameter, and the low pressure is 80 in., while the length of stroke is 54 in. Steam is generated by two boilers, each fired from both ends. The propeller blades are movable, so that if one is broken a new one can be easily screwed on in its place. There are four steam winches for working cargo, steam for which is supplied by either the donkey or main boilers. She is intended to run in the cattle trade between North America and the United Kingdom, and will accommodate on her three decks 750 to 800 head, besides carrying fully 12,000 quarters of grain in her holds. Very complete arrangements have been made for the thorough ventilation of the ship. There is ample accommodation for the crew, the officers' berths and saloons being at the after end of the main deck, and the seamen's berths in the forecastle. In addition there is suitable accommodation for the cattlemen. The launch was singularly successful, and as the vessel left the ways she was gracefully christened the *Carmona* by Mrs. Moncur, wife of Mr. A. H. Moncur, one of the owners. When the magnificent ship took the water loud cheers were raised by the spectators.

Krete.—On April 28th Messrs. H. M'Intyre & Co. launched from their building yard at Merksworth, Paisley, an iron screw-steamer named the *Krete*, which has been built to the order of Cavalero D. P. Gudi, Naples. The steamer, which has been built under the superintendence of Capt. N. G. Gudi, her future commander, is intended for passenger and goods traffic in the Archipelago. She is built to the highest class at Lloyd's, and her cargo and other appliances are of the most modern description. The makers of the engines are Messrs. Hutson & Corbett, Glasgow. The ceremony of naming was performed by Miss Mary Orr, Hillhead, Glasgow.

Vesta.—On April 30th there was launched from the shipbuilding-yard of Messrs. Scott & Co., Cartsdyke, Greenock, an iron-screw steamer, of 3,400 tons and 400-h.p., built to the order of Messrs. Rathbone Brothers & Co., Liverpool, for the Star Navigation Company. The dimensions of the steamer are as follow:—Length, 365 ft.; breadth, 39 ft.; and depth, 28 ft. 7 in. As she left the ways the vessel was named the *Vesta*.

Carnarvonshire.—On April 30th, the London and Glasgow Shipbuilding Company (Limited), launched at Govan, for Messrs. Jenkins & Co., of London, an iron screw steamer, of about 2,500 tons gross register, her dimensions being—Length, 330 ft.; breadth, 35 ft. 6 in.; depth, 25 ft. 8 in., and built to Lloyd's highest class for three-deck vessels. This steamer, which will be fitted by her builders with compound surface condensing engines, of 350 nominal horse power, of the most approved type, and combining all the latest improvements, steam-steering gear, &c., will form one of Messrs. Jenkins & Co.'s well-known "Shire" Line, trading between London and Japan. As the vessel left the ways she was named *Carnarvonshire* by Miss Campbell, daughter of Bailie Campbell, Govan.

Iolanthe.—On April 30th an iron steam yacht, named the *Iolanthe*, was launched from Messrs. Ramage & Ferguson's shipbuilding-yard at Leith. By yacht measurement the tonnage is 620 tons, and her dimensions are:—Length, over all, 205 ft., length, keel, and forerake, 185 ft., breadth, 27 ft., and depth, 16 ft., moulded. Every recent improvement in yacht construction has been introduced. The engines, which are of 110-horse power nominal, are being supplied by Messrs. Matthew Paul & Co., Dumbarton, and have cylinder 27 in. and 50 in. diameter, by 30 in. stroke, and a speed of about 13½ knots per hour is expected to be obtained. The *Iolanthe* has been built to the order of T. J. Waller, Esq., London, and has been specially designed for long foreign cruises. On leaving the ways the ceremony of naming her was performed by Miss Waller, eldest daughter of the owner.

Aranmore.—On April 30th a new screw steamer of 1,100 tons, built and engined by Messrs. W. Simons & Co., was launched complete from their works at Renfrew. She is the property of the Clyde Shipping Company, and is the seventh steamer constructed for them by this firm. She is named *Aranmore*, and is intended for the Channel trade, having cabin accommodation. This steamer is fitted with compound engines and steel boilers of 700-horse power, and is also fitted with steam appliances for loading, mooring, steering, ventilating, and discharging, and has the highest class at Lloyd's and the Board of Trade.

Hebridean.—On April 30th Messrs. Thomas B. Seath & Co., Shipbuilders, Rutherglen, launched from their yard an iron screw steamer of 350 tons burthen, and of the following dimensions:—140 ft. long, 23 ft. 6 in. beam, and 12 ft. deep. She has a spar deck fore and aft, and will be fitted with compound engines of 70-horse power nominal. The steamer, which was named the *Hebridean*, has been built to the order of Messrs. John M'Callum & Co., Glasgow, and will be engaged in the West Highland passenger, goods, and cattle trade. She is expected to attain a speed of 11 knots an hour.

Lydian Monarch.—On May 2nd the steamship *Lydian Monarch*, built to the order of the Royal Exchange Shipping Company, London, was launched from the dockyard, Dumbarton. The *Lydian Monarch* is the last of three similar vessels built by Messrs. M'Millan for this firm, the two former of which were of iron, and this one of steel. They are all intended for the new Monarch Line, to trade from London to New York, carrying first-class passengers, emigrants, cattle, fresh meat, and a general cargo. The principal dimensions are as follow:—Length, 370 ft; breadth, 43 ft.; depth, 35 ft. 9 in.; tonnage, gross, including shelter deck space, about 4,000 tons. The engines, made by Mr. David Rowan, Glasgow, are compound double-cylinder, inverted, direct acting, of 2,800-horse power, the cylinders being respectively 47 and 87 inches diameter, with a piston stroke of 57 inches, and supplied by steam, at a pressure of 80 lbs, from three boilers having 12 Fox's patent corrugated furnaces. The ship is four-masted, square-rigged on the two foremost, and the amount of canvas available is such that in case of emergency the vessel would be safely navigable by sail alone. The *Lydian Monarch* obtains the highest class in the Societies of Lloyd's and the Bureau Veritas. On leaving the ways the vessel was named by Mrs. W. H. Westhorp, Buckhurst-hill, Essex.

Vixen.—On May 2nd Messrs. Cunliffe & Dunlop launched from their yard at Inch Works, Port Glasgow, a screw steamer, built to the order of Messrs. Mello & Co., Para, Brazil. This vessel, which is intended for passenger and cargo traffic on the Amazon River, has been during construction under the superintendence of Mr. Guilherme Fox, and is of the following dimensions:—Length, 160 ft.; breadth, 25 ft.; depth of hold, 11 ft.; tonnage B.M., 485 tons. After the launch the vessel was moored alongside the builders' wharf for completion, and will be fitted with compound direct-acting engines of 70-horse power nominal, with latest improvements. The ceremony of naming the steamer *Vixen* was performed by Miss Fox, of Broomhill-terrace, Partick.

Taldora.—On May 4th the Campbeltown Shipbuilding Company launched a screw steamer called the *Taldora*, built for the Australian coasting trade to the order of Messrs. M'Ilwraith, M'Eacharn, & Co., of London, and is the second vessel the Campbeltown Shipbuilding Company have built for this firm. The dimensions of the steamer are 130 ft. by 23 ft. by 9 ft. She is of 300 tons burthen, fitted with shade decks, &c., and is admirably adapted for the trade. The vessel has been built under special survey, and will be provided with engines of 60-horse power by Messrs. Kincaid, Donald & Co., of Greenock.

Modena.—On May 5th Messrs. Robert Steele & Co., Greenock, launched from their shipbuilding-yard a steamer built to the order of Messrs. James Currie & Co., Leith, for the Leith, Hull, and

Hamburg Steam Packet Company. The steamer has been built of steel, and is of the following dimensions:—Length, 250 ft.; breadth, 33 ft.; and 17 ft. 3 in. in depth. Her gross tonnage is 1,210, and her nett tonnage 770. She will be fitted with compound surface condensing engines of 120-horse power nominal. The new steamer is similar to the *Ferrara*, which was built for the same owners last year. As the steamer left the ways she was named the *Modena* by Miss Currie, daughter of the Managing Owner.

Sao Felix.—On May 12th Messrs. Heury Murray & Co. launched from their yard a paddle steamer named the *Sao Felix*, of the following dimensions:—Length, 180 ft.; breadth of beam, 23½ ft.; depth of hold, 8 ft. The engines, to be supplied by Messrs. Kincaid, Donald, & Co., Greenock, will be of 150-horse power. The *Sao Felix* has been built for Messrs. Kincaid, Donald & Co., to the order of Messrs, Knowles & Foster, London, and her owner is H.E. the Viscount Marinho of Bahia, Brazil. She is to trade along the Brazilian coast, and will carry passengers and mails.

Fidra.—On May 12th Messrs. Alex. Stephen & Sons launched at Linthouse, Govan, an iron screw steamer, classed 100 A 1, under special survey. She was named the *Fidra* by Mrs. Reid, wife of Mr. Francis F. Reid, of Leith, to whose order the vessel has been built. The *Fidra* is a steamer of about 1,150 tons, of the most modern and improved type, with water ballast arrangements, and all the best appliances for working cargo, &c. Her engines, also Messrs. Stephen's own make, have cylinders 29 and 56 inches diameter by 36 stroke, with a working pressure of 75 lbs. The vessel is intended for the Eastern coasting trade.

Clan Macfarlane.—On May 12th an iron ship was launched from the shipbuilding yard of Messrs. Russell & Co., Glasgow. The vessel has been built to the order of Mr. Thomas Dunlop, of Glasgow, and is of the following dimensions:—Length, 250 ft.; breadth, 38 ft.; depth, 22 ft. 9 in.; tonnage, 1,500 register; to carry a deadweight of 2,400 tons. As the ship left the ways she was named the *Clan Macfarlane*, by Mrs. David Richmond, Broom Park, Pollokshields. She has been furnished with all modern appliances for facilitating the loading and discharging of cargo. It is intended to employ her on the East India trade, and this has been kept in view in her construction and fitting out.

John Smith.—On May 13th there was launched from the shipyard of Messrs. Barr & Shearer, at Ardrossan, a three-masted schooner, built for the Newfoundland fish trade. Her dimensions are:—Length between perpendiculars, 102 ft.; beam, 22 ft. 6 in.; depth of hold, 10 ft. 9 in. The vessel is owned chiefly by Captain Charles Hendry, who has been a shipmaster in the East Indian trade. As she left the ways she was named the *John Smith* (a mark of respect to Mr. John Smith, shipping agent) by Miss Maggie Smith.

Kilmodan.—On May 14th Messrs. Russell & Co. launched at Glasgow a barque of the following dimensions:—Length, 258 ft.; breadth of beam, 38 ft.; depth of hold, 22 ft. 9 in.; of 1,520 tons, and to carry 2,580 tons dead-weight cargo. As she left the ways she was named the *Kilmodan* by Miss Margaret C. Newton, daughter of Mr. William Newton, Eaton Gardens, Glasgow, one of the managing owners. The *Kilmodan* has been built for Messrs. Kerr, Newton, & Co., Glasgow, and is of the same model as the *Cromartyshire*. The *Kilmodan* will load at Port Glasgow for San Francisco.

Rome.—On May 14th the *Rome* (s), constructed by Messrs. Caird & Co. for the Peninsular and Oriental Steam Navigation Company was launched at Greenock. The dimensions of the ship are as follows:—Length, 430 ft.; breadth, 44 ft.; depth, 36 ft.; gross measurement, 5,100 tons. She received her name from Mrs. Barnes, wife of one of the directors. The engines have also been constructed by Messrs. Caird & Co. They consist of four cylinders, having a stroke of 5 ft., surface condenser, centrifugal and other pumps, &c. It may be mentioned that the crank shaft, which is in two pieces, weighs 30 tons. The boilers are six in number, and of steel, and suitable for a working pressure of 90 lbs. The number of furnaces is 30. She has four masts, two funnels, and short poop and forecastle. The ship is provided with powerful appliances for loading and discharging cargo, pumping, extinguishing fire, steering, &c., &c. Those for starting and reversing the engines, controlling them in stormy weather, &c., are of the most modern description. She will carry a large Bell-Coleman refrigerating machine, with cooling chamber. The *Rome* is the largest ship ever built in Greenock, being 100 tons more in gross measurement than the *City of Berlin*, built by the same firm. The *City of Berlin* is, however, 20 ft. longer than the *Rome*.

Lizard.—On May 16th Messrs. Blackwood & Gordon launched from their shipbuilding-yard, at Port Glasgow, the screw-steamer *Lizard*, built to the order of Mr. John Burns for the cargo trade between Greenock and Belfast. The following are her dimensions:—190 by 26 by 14·6. She will be supplied by her builders with compound engines of 100-horse power. On leaving the ways she was named by Miss Blackwood, daughter of the builder.

Craigallion.—On May 7th there was launched from Messrs. Ramage & Ferguson's shipbuilding yard at Leith, an iron screw steamer, named the *Craigallion*, of about 1,000 tons gross register, for Messrs. Walker, Donald & Co., Glasgow. This steamer's dimensions are—216 by 30 by 16 ft. moulded, with engines 20 and 50 by 33 stroke, and her general design is somewhat similar to the screw steamer *Craigrownie*, launched six months ago for the same owners. On leaving the ways the *Craigallion* was named by Miss Glover, Mount Grange, Edinburgh, and was afterwards towed round to the harbour to receive her machinery.

Strathdee.—On May 7th there was launched from the shipbuilding-yard of Messrs. Dobson & Charles, at Grangemouth, a screw steamer, built to the order of Messrs. James Hay & Son, Glasgow, and intended for the West Coast trade. Dimensions—140 ft. by 21 ft. 6 in. by 11 ft.; tonnage, 400. She will be fitted with compound surface-condensing engines of 60-horse power nominal by Messrs. Scott Bros., Engineers, Glasgow, and fitted with all the latest improvements. As she left the ways the ceremony of naming her the *Strathdee* was performed by Miss Isa Charles, daughter of the builder.

Corsican.—On May 17th Messrs. Murdoch & Murray launched from their shipbuilding yard at Port Glasgow an iron screw-steamer, named the *Corsican*, built to the order of Messrs. J. & J. Macfarlane, Glasgow. The following are her dimensions:—215 by 30 by 15, and of between 1,100 and 1,200 tons. She will be supplied with compound engines of 120-horse power by Messrs. William King & Co., of Glasgow.

Skjold.—On May 19th there was launched from the yard of Messrs. Lobnitz & Co., Renfrew, a screw-steamer of the following principal dimensions:—Length of keel and forerake, 246 ft.; breadth of beam, 34 ft. 2 in.; depth of hold, 18 ft.; and is classed in the highest class of Bureau Veritas. She is to be fitted with machinery of 160-horse power nominal. The vessel is built for L. H. Carl, Esq., of Copenhagen, and will be commanded by Captain Aaris, under whose superintendence the vessel has been built. On leaving the ways she was named the *Skjold* by Miss Lobnitz, and immediately thereafter taken into the builder's dock, where she will receive her machinery.

Mauritius Reunion.—Messrs. W. Hamilton & Co. launched from their shipbuilding-yard at Port Glasgow, on May 18th, a handsomely-modelled screw-steamer of the following dimensions:—Length, 299 ft.; breadth, 36 ft.; depth, 25·6 in.; deadweight, 3,000 tons. This steamer will be fitted with compound surface-condensing engines of 250-horse power nominal. She has water ballast throughout on the new cellular principle, and will be fitted with steam steering gear (Bow & McLachlan's patent), steam windlass, and all the latest improvements, and classed 100 A 1 at Lloyd's. She has splendid accommodation for first and second class passengers. This steamer has been built to the order of Messrs. Gravier & Co., Marseilles, for the Company Maurice-Reunion, and is the first of a regular line of steamers, to trade between London, Marseille, Mauritius and Reunion, viâ Suez Canal. On leaving the ways she was named the *Mauritius Reunion* by Mrs. F. G. D. Bryan, of Frederickstadt Drumpellier. We understand the builders have other two steamers of the same size in course of construction for this line, and they have been contracted through a London firm, Pothonier & Co., 21, Great St. Helen's.

LAUNCH.—IRISH.

Asiatic.—On April 30th at high water, about half-past eleven o'clock, a new White Star liner was launched from the shipbuilding yard of Messrs. Harland & Wolff, Queen's Island, Belfast. As is well known, the vessels of the celebrated White Star fleet were constructed by this firm. Large crowds assembled at the quay to witness the launch, in which very great interest was manifested on both sides of the river, and which, we must say, was accomplished in a most successful manner. The new vessel, which is to be named the *Asiatic*, is built of Siemens-Martin steel, is 430 ft. in length, 42 ft. beam, and is about 4,300 tons gross register. Her saloon passenger accommodation is superb, and everything possible has been provided for those who may go steerage. The *Asiatic* will be classed very high on the register. Her engines, &c., are all on the most modern principle, and will be fitted up here by Messrs. James Jack & Co., of Liverpool. The windlass, winches, and steering gear are to be supplied with the latest improvements, and, of course, will be driven by steam. Messrs. Harland & Wolff have at present on the stocks a steamer of similar dimensions to the *Asiatic*, a large steamer for the

Peninsular and Oriental Steam Navigation Company, and a duplicate to the steamer Winnebah, which was launched from the Queen's Island Shipbuilding Yard only a short time since. After the launch a number of ladies and gentlemen were entertained at luncheon on the Queen's Island.

On April 30th Mr. Thomas Norris launched from his yard, at Prince's Dock, a handsome steam yacht, built to the order of Colonel H. S. Beresford Bruce, D.L., Castle-dawson. Its dimensions are—Length, 45 ft.; breadth of beam, 9 ft.; moulded depth, 5 ft. The cabins are raised, and the boiler and machinery, will, it is said, be on the newest principle.

TRIAL TRIPS.

Bothwell Castle.—On April 28th the trial trip of this steamer took place from the yard of her builders to the Royal Albert Dock, London, and was in every way a success. She has been built by Messrs. Raylton, Dixon & Co., of Middlesbrough, to the order of Messrs. Thomas Skinner & Co. to take her place in their Castle Line of steamers to China. The steamer in question will carry 4,000 tons of tea on a draught of water of 21 ft., and on her trial trip, when loaded down to this depth, she maintained an average speed of over 12 knots between the Tees and London. Her leading dimensions are 345 ft. long over all, 38 ft. 6 in. beam, and 26 ft. depth of hold, having a gross register tonnage of 2,550 tons. She is built on the three-decked rule. The deck houses and casings are all of iron, and the decks, charthouse, rails, &c., are of East India teak. Her rig is brigantine with pole masts. The engines, which are of 300-horse power nominal, are built by Messrs. T. Richardson & Sons, of West Hartlepool, and have all the latest improvements. She has steam windlass and steam steering gear, and water ballast in after hold.

Ravensheugh.—On April 30th the new screw steamer *Ravensheugh*, built by Palmer's Shipbuilding and Iron Company (Limited), Jarrow, for Messrs. Bowser & Ormston, Newcastle, had her trial trip at sea. The vessel is 270 ft. long, 35 ft. broad, and 23 ft. deep; and is fitted with a pair of Palmer's celebrated engines of 180-horse power nominal. She is also fitted with Messrs. Bow, McLachlan, & Co.'s (Paisley) steam steering gear, which during the trial acted with great efficiency and smoothness. The *Ravensheugh* is intended for the general carrying trade, and will be under the command of Captain Munro. Owing to the unpropitious state of the weather, it was found impracticable to get the vessel "on to the mile," but the speed obtained was computed at about 11 knots per hour.

Abeona.—On April 30th the screw steamer *Abeona*, built by Messrs. Bartram, Haswell & Co., South Dock, Sunderland, to the order of Messrs. Graham, Anderson, & Co., wholesale timber merchants, of Maryport, Carlisle, and Tyne Dock, was taken to sea for her trial trip. The following are the dimensions of the *Abeona*, which is registered at Newcastle:—Length between perpendiculars, 200 ft.; breadth of beam, 30 ft.; and depth of hold, 15 ft. 6 in. Her total deadweight carrying capacity is about 1,250 tons. She is fitted with steam windlass, winches, &c., for the rapid loading and discharging of cargo. The steamer is fitted with compound surface-condensing engines of 100-horse power, by Mr. John Dickenson, of Sunderland, and they combine all the latest improvements in Marine engineering. The building and fitting out of the vessel have been carried out under the inspection of Captain Mail, superintendent for the steamers belonging to Messrs. Westoll & Co., of Sunderland. The speed of the vessel was tried with and against the tide, and the result was that a mean speed of about 9½ knots an hour was obtained. The engines worked with perfect smoothness, and the speed was considered highly satisfactory.

Huntingdon.—On May 5th the new screw steamer *Huntingdon*, recently built to the order of Messrs. W. Milburn & Co., of Newcastle, made a successful trip to sea. This vessel is 300 ft. long, 36 ft. wide, with a depth of 26 ft., and is supplied with engines of 260-horse power. She made about 12 knots per hour. In connection with the trip a new lifebouy was exhibited on board. To test its qualities four of the company got into the lifebuoy, which was lifted by a derrick usually employed for discharging vessels, and was deposited in the water. The buoy, with its living freight, was afterwards towed into the Tyne by a steam-tug.

Grangefell.—On May 7th the trial trip of the screw-steamer, *Grangefell*, built by Messrs. R. and J. Evans & Co., of Brunswick Dock, Liverpool, to the order of Messrs. Hume, Smith & Co., took place on the measured mile on the Mersey, when the vessel attained the speed of 10¼ miles per hour, the engines working at 87 revolutions per minute. She has been specially constructed for the Workington trade, carrying railway iron, and is of 2442 tons gross and 143 nett register. Her dimensions are 120 by 22 by 10, and she has been supplied by Messrs. David Rollo & Sons with a steel boiler, capable of bearing 80 lbs. pressure, and engines of 55-horse power, cylinders 17 and 32 in. diameter, having a 26-in. stroke. In addition to the testing the speed of the vessel over the measured mile her capabilities were further proved by a run as far as the Bar Lightship. The *Grangefell* will be under the command of Captain Tarbot.

Ban Whatt Soon.—On May 11th the new screw steamer, *Ban Whatt Soon*, built and engined by Messrs. Blackwood & Gordon for a Chinese firm, went on her trial trip. The measured mile was accomplished, notwithstanding the steamer being heavily loaded, at over 10 knots, being above contract speed.

Iron Acton.—On May 11th this steamer, which has recently been built by Messrs. Raylton Dixon & Co., of Middlesbrough, to the order of Messrs. King Brothers, of Bristol, proceeded on her trial trip. Her dimensions are:—Length over all, 235 ft.; breadth, 32 ft. 6 in.; and 16 ft. depth of hold; and she will carry about 1,450 tons deadweight. She has been designed specially for the Baltic timber trade, in which she will be principally employed by her owners. She has iron decks right fore and aft, cabin accommodation under the bridge, water ballast in both holds and engine-room, and has been fitted with engines of 100-horse power by Messrs. Thomas Richardson & Sons, of Hartlepool. After adjusting compasses off the mouth of the Tees, she proceeded on her trial trip to the Tyne, on which, with her tanks full, she maintained a speed of between 10 and 11 knots.

Trevilley.—On May 11th the *Trevilley* (s.), built by Messrs. T. Redhead & Co., of South Shields, made a successful trip to sea. This vessel is 245 by 32·9 by 11, is classed 100 A 1 at Lloyd's, and has been built to the order of Messrs. E. Hain & Son, of St. Ives, Cornwall. This is the third vessel Messrs. Redhead have built for the same owners. On her return to Shields from sea she was taken up the Tyne to Pelaw Staithes to load a cargo of coals for Civita Vecchia.

Quettah (s.)--On May 17th the *Quettah* (s), launched by Messrs. Wm. Denny & Brothers, Dumbarton, for the British India Steam Navigation Company, went down the Clyde on a trial trip. The *Quettah* is a vessel of 380 ft. by 40 ft. by 30 ft. 6 in., and about 3,400 tons. She is intended for the London and Calcutta Line of the British India Steam Navigation Company. She has compound surface-condensing direct acting inverted cylinder engines of 500-horse power, constructed by Messrs. Denny & Co., Dumbarton. She is fitted for a large number of first and second class passengers. Amongst other features of the vessel, she is fitted with hydraulic gear for the purpose of discharging the cargo, steering the ship, heaving the anchor, as well as working a 30-ton capstan aft. The principal feature of this gear is that the cargo can be discharged with greater speed than by steam winches, and at the same time with an absence of noise. The hydraulic gear was prepared by Messrs. Brown Brothers & Co., Edinburgh and London. The automatic steering is due to a combination of electric and hydraulic machinery, under a recent patent, by Messrs. Brown & King. The ship on her trials behaved in a most satisfactory manner. With 2,070 tons on board she attained a speed of about 14 knots an hour. The engines worked with the greatest smoothness.

Perseverance.—On May 17th the screw steamer, *Perseverance*, of Sunderland, left the South Dock on her trial trip, previous to her proceeding on her first voyage to the Mediterranean. The steamer, which was built by Messrs. Short Bros., Pallion, to the order of Messrs. Freear & Dix, is rigged as a brigantine, and is of the following dimensions:—Length over all, 226 ft.; between perpendiculars, 220 ft.; extreme breadth, 32 ft. 5 in.; depth of hold, 16 ft. 3 in. Her registered tonnage is 717 tons. When she left the dock she drew 15¼ ft. of water, carrying 1,500 tons of coals, including bunkers. She has a half-poop to bridge, with full topgallant forecastle, and her decks are of iron. Her classification is the highest in Liverpool registry. After her launch the vessel was fitted with a pair of direct-acting compound surface condensing engines of about 110-horse power by Mr. John Dickinson, of Palmer's Hill. All the latest improvements are combined, including boilers of 80 lbs. pressure, adapted to consume any class of coal, fitted with Churchill's steam governors. After leaving the entrance, the vessel steamed southward past Seaham until the compasses had been adjusted, and then her head was turned north and she proceeded nearly to the Tyne, the engines running very smoothly and all the machinery on board working with perfect freedom. The log was put over, and after a lapse of half an hour it was found the vessel had been travelling at the rate of 10 knots per hour, a speed highly satisfactory to all concerned. The engines worked at the rate of 62 revolutions per minute.

Kingsley.—On May 19th the screw steamer, *Kingsley*, built by

Messrs. T. & W. Smith, North Shields, was taken to sea for her official trial trip. The *Kingsley*, which is owned by Messrs. Ed. Eccles & Partners, Newcastle, is a vessel of 180 ft. in length, 30 ft. 3 in. in beam, and 13 ft. 6 in. draught of water. Her nett register is 450 tons. She is destined for the coasting and Bilbao trades. She has steam winches, steam windlass, three of Archer's patent hoists, together with other machinery for quick despatch in discharging cargo. She was engined by Messrs. R. & W. Hawthorn, Newcastle, who put in one of the usual compound surface condensing engines, of 100-horse power. The engine is fitted with Marshall's patent valve gear for rapid reversing of the engine. She has also one of Durham's governors for controlling the propeller's speed when in a seaway. The vessel was loaded previous to the trial to a mean draught of 12¼ ft. and she registered a speed of between nine to ten knots an hour when on the measured mile.

Three new gunboats, built by Messrs. C. Mitchell & Co., Low Walker, on the Tyne, engined by Messrs. R. & W. Hawthorn, of Newcastle, and armed by the Elswick Ordnance Works, left the Tyne on May 19th. They are named the *Iota*, *Kappa* and *Lambda*, and are built of steel. The *Lambda* will proceed to Canton, and the *Iota* and *Kappa* to Tientsin; they are in chief command of Captain John Ross on their passage out. They will be followed by two powerful turret ships, which are nearly ready for sea. The crews of all the vessels are Chinese.

Aristides.—On May 21st this steamer was taken for a run outside the Mersey. She has been built to the order of Messrs. Layborne & Legge, Steamship Owners, by Messrs. T. Roydon & Sons, and engined by Messrs. J. Jack & Co. Her carrying capacity is 2,300 tons, and she is fitted with all approved modern appliances. The speed on the measured mile was 10¼ knots, which was considered very good for the power employed; and the consumption of fuel will also be small, a novelty in her machinery being the split boss propeller, intended to overcome the loss of time usually taken up in overhauling, and at the same time giving greater security against becoming loose while working. After the trial the steamer was placed on her berth for loading, and will be immediately despatched for Rangoon. She has been superintended throughout by Messrs. Cooke & Mylchrest, and will be commanded by Captain De Silva.

Pembroke.—The *Pembroke*, steel paddle-wheel steamer, recently completed by Messrs. Laird Brothers, Birkenhead, for the Great Western Railway Company, for their express service between Milford and Waterford, has just been put on her station, and made the first run over at a speed of 15·42 knots, and the return voyage in 5 hours 49 minutes, giving a speed of 14·97 knots.

A six hours' continuous steam trial was recently made at Portsmouth of the two gunboats, *Bouncer* and *Insolent*, which had been brought round from Pembroke, where they were built. These craft are 87 ft. long and 26 ft. in beam, and, with the sister ships, *Pincher*, *Tickler*, *Gadfly*, and *Griper*, were engined by Messrs. John Penn & Co., of Greenwich. Though the machinery is in all respects the same in all the gunboats, having cylinders of 20 in. diameter, of which the trunk is 11¼ in., and a stroke of 1 ft. 3 in., the last two boats differ in some important respects from the four others. They are constructed of steel instead of iron, and are besides provided with bow rudders to assist in turning. The draught of both vessels was the same—viz., 6 ft. forward and 6 ft. 6 in. aft. With a mean of 154 revolutions, the *Bouncer* developed 228 horse-power, and realized a speed of 8·021 knots; while with 156 revolutions per minute the *Insolent* developed 232 horse-power and attained a speed of 8·064 knots an hour. The performances of each vessel are thus practically the same. The trials were perfectly satisfactory, the contract power being 168 horses. The *Bouncer* and *Insolent* are intended for coast defence, and will each carry one large gun.

Dawn, (s.s.)—This steamer, built to the order of the Tobago Steamship Company, Limited, had her trial trip on the river, Friday, May 20th. Length, about 100 ft., breadth, 15 ft., and depth 8 ft. 6 in., carrying capacity 100 tons, and speed 9 knots. This vessel is intended for use on the coast of Tobago and from that island to Trinidad; thus performing the work at present done by sailing vessels. We understand that the enterprising manager, Mr. Dawson, has secured a subsidy from Her Majesty's Government for the carriage of the bi-monthly mails between the Islands and Trinidad where they are reshipped on board the mail steamer for Europe. We are happy to say the trial trip fully came up to the anticipations of the owners, and Messrs. Pile & Co., of 34 Great St. Helens, London, the contractors.

THE *American Manufacturer* says China's mercantile marine compares very favourably with Great Britain's, the tonnage of the former being 4,100,000, and of the latter, 6,115,638.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

LOOSE PROPELLER.

To the Editor of the MARINE ENGINEER.

DEAR SIR,—You kindly inserted a letter of mine some time ago, regarding the recognition by the Board of Trade to engineers of merchant steamers for exceptional services rendered in the case of accidents to machinery at sea. There is a case recently of the chief engineer of a steamer going out to China having a loose propeller. Instead of incurring a heavy expense in docking or otherwise, he constructed a tube from tarpaulins with hoops inside and an old cask at the bottom, weighted to sink. He then made two pockets for his arms, with a glass in a suitable position to enable him to examine the defects. He was able to screw up the nut, and also fit a new key to secure it. Surely when a man brings his skill and presence of mind to bear in cases like this, not only saving expense and possibly delay the ship, independent of any pecuniary consideration, it would only be just if the Board of Trade were to recognize such services. Seeing that your journal is getting widely known among engineers, and is carried on in these interests, perhaps you would kindly bring cases of this kind before your readers. There are others I could mention equally deserving of notice, and I am sure it would give great pleasure to the majority of your readers to see them recorded in your journal.

I am, yours truly,
I. M.

St. Vincent, *April 16th*, 1881.

THE TONNAGE OF SHIPS.

To the Editor of the MARINE ENGINEER.

SIR,—With reference to the letter in your last number, it may be of interest to your readers to know that some doubts have arisen as to the meaning of the Statutes. Under the merchant Shipping Acts the tonnage is found by measuring the whole space included in the ship, and then making certain deductions; but Mr. Chamberlain is introducing a Bill declaring that the proper meaning of the Statutes is that nothing be included in the deductions that has not first been included in the measurement.

Yours obediently,
S. P. WILDING.

23, Rood Lane, London, E.C.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 22nd April to 19th May, 1881.

1733. O. Frossin. Steam engines with superheated steam.
1746. J. Lyle. Rotary engines.
1749. W. H. Wood. Boiler tubes or flues.
1752. C. Jones. Screw propellers.
1755. R. C. Christian and G. Coates. Reversing gear for engines.
1757. A. M. Taylor. Boiler safety valve plugs.
1771. D. Greig and M. Eyth. Valve motions for double cylinder engines.
1790. E. J. Woodhouse. Diving costumes, explosives, breaking of wreckage, &c.
1793. B. Brazelle. Steam generators.
1800. E. Johnson. Oyster culture.

1807. A. M. Clarke (communicated by W. S. Hughes, J. Gregory and C. J. Howe). Slide valves.

1809. W. R. Lake (communicated by P. B. Delany). Telegraphic cables.

1819. R. Macpherson. Furnace fire bars.

1846. J. Swalwell. Rotary engines.

1853. J. I. Thornycroft. Propelling and steering.

1868. W. N. Hutchinson. Torpedoes and their projection.

1933. D. Woollatt. Obtaining and applying motive power.

1938. M. H. Gerring and R. E. Rumsey. Main and thrust block bearings of main crank and propellor shafts, and prevention of overheating.

1953. C. Pieper (communicated by R. Schwartzkopff). Electrical apparatns to control lowest water level and maximum temperature in steam boilers.

1955. H. Thibalt and T. Hawkins. Rotary engines.

1956. W. R. Lake (communicated by A. Khotmsky). Respiratory apparatus for submarine use.

1959. R. H. Robinson. Valve gear.

1969. A. M. Hopkins. Signal lamps.

2012. H. J. Haddan (communicated by A. Guérolt and A. Blondel). Hoisting and lowering.

2020. B. J. B. Mills (communicated by S. Guiehard). Barometers.

2028 G. and W. H. Good. Waterproof canvas, &c., and treatment of twines and threads for sailmaking, &c.

2034. H. Whitehead. Automatic fog signal.

2045. W. R. Lake (communicated by R. Lighthall). Burning liquid hydro-carbon.

2068. J. Hunter and others. Steam engines.

2069. C. Pieper (communicated by W. R. Poell).

2074. W. F. Whiteman (communicated by Defalque & Co.). Stuffing box packing.

2083. J. Robson. Motive power engines.

2084. B. C. Scott. Capstans.

2086. F. and S. Pearn and T. Addyman. Steam pumps.

2088. J. M. B. Baker. Conveying intelligence between vessels, &c.

2109. H. Linley. Speed controlling mechanism.

2121. W. R. Lake (communicated by J. B. Root).

2125. A. Figge. Propelling and steering.

2127. F. W. Brewster. Life preserving garment or appliance.

2128. A. B. Brown and W. F. King. Steering apparatus.

2129. W. R. Lake (communicated by A. M. Pleisehl). Safety valves.

2130. W. M. Brown (communicated by H. Lindemann). Steering apparatus to produce even tension at all positions to avoid slack.

2133. W. R. Lake (W. H. and A. J. Jacobs). Rotary engines, pumps, &c.

2148. H. H. Lake (communicated by J. W. Chisholm). Compound steam engines.

2156. J. H. Johnson (communicated by A. J. A. Lagane). Torpedo boats.

2165. F. Wolff (communicated by C. Mollerup). Lubricators.

2167. W. Askew and A. Aaird. Valves.

2180. A. L. Normandy. Distilling apparatus to produce fresh from salt water, more particularly in steam ships.

2187. W. Allen. Marine steam engines.

2192. J. Cartwright. Motive power engines.

2197. A. Boudeville. Economizing fuel.

⁂ Any information regarding these or other patents will be gladly furnished on application.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

April 23rd, 1881.

Abey, Henry	1 C	N Shlds.
Armstrong, Ralph	1 C	do.
Aynsley, Robert	1 C	do.
Booth, Robert	2 C	Aberdn.
Cantlay, George	2 C	Lvrpool.
Callan, John	1 C	do.
Ellison, William	1 C	London.
Fleming, Thomas	2 C	Lvrpool.
Harper, James	2 C	London.
Hall, John	2 C	Aberdn.
Kane, M.	1 C	Lvrpool.
Moore, George	2 C	N Shlds.
Munro, Emanuel	2 C	London.
Möller, Edward	1 C	Grnock.
Mathie, John	1 C	do.
Ritson, Robt. C.	2 C	Lvrpool.
Risk, Allan G. Mc G.	1 C	Shmptn.
Stalker, Robert	1 C	Grnock.
Sheppard, Harry	2 C	London.
Shuttleworth Jno.	1 C	N Shlds.
Sutherland, John	2 C	Lvrpool.
Storey, James	1 C	do.
Taylor, Thomas	2 C	do.
Thienpondt, John C.	1 C	London.
Thomas, Richard Henry	2 C	do.
McCaig, Robert	2 C	Lvrpool.
Millar, Walter	1 C	Hull.
Milbanke, Wm.	1 C	Sndrlnd.
McQueen, R.	1 C	Lvrpool.
Neilson, Robert	1 C	Glasgw.
O'Brien, Michael	1 C	Lvrpool.
Parken, Moses	2 C	do.
Price, Edward	2 C	do.
Robson, George	1 C	Sndrlnd.
Ross, Edward W.	1 C	London.
Roberts, William	1 C	Hull.
Reid, Robert S.	2 C	Glasgw.
Selby, Johnson	2 C	N Shlds.
Stewart, John B.	1 C	Glasgw.
Scott, Alexander	1 C	do.
Taylor, Peter	1 C	do.
Taylor, Luke	2 C	N Shlds.
Thorp, Joseph	1 C	do.
Wilson, James B.	2 C	Glasgw.

April 30th, 1881.

Addison, James	2 C	Aberdn.
Bookhurst, James M.	1 C	London.
Chambers, Jno. W.	2 C	Sndrlnd.
Davies, Thomas	1 C	N Shlds.
Hayes, Sam A.	1 C	London.
Hansen, H. G.	2 C	Sndrlnd.
Kitching, John	2 C	N Shlds.
Mulvenna, Chas.	2 C	Sndrlnd.
Maher, Henry	2 C	Cork.
Nicholson, Jsph.	2 C	N Shlds.
Reid, John	1 C	Aberdn.
Simpson, Hercules S.	2 C	N Shlds.

May 7th, 1881.

Adamson, J.	1 C	Lvrpool.
Acker, Van Seraphin	2 C	N Shlds.
Amess, John	2 C	do.
Allan, James	1 C	Glasgow
Ballantyne, Wm.	2 C	do.
Borrill, John	2 C	N Shlds.
Cumming, Walter S.	1 C	Glasgw.
Cochrane, John	1 C	do.
Downey, William	2 C	N Shlds.
Earnshaw, Robert	2 C	do.
Eidmann, Wm. H.	1 C	London.
Eggington, Wm. S.	2 C	Lvrpool.
Fraser, Hugh	1 C	Glasgw.
Gordon, Thomas	2 C	do.
Galloway, Chas. T.	2 C	do.
Griffiths, Chas. P.	1 C	Lvrpool.
Hunter, John	2 C	do.
Hopper, D. H.	2 C	N Shlds.
Jamieson, Jas.	2 C	Glasgw.
Law, John	1 C	N Shlds.
Lawrie, Alexander	2 C	Glasgw.
Marr, George	2 C	do.
Moir, James	1 C	do.
Moir, Robert	2 C	do.
McIntyre, Wm.	2 C	do.
McDowall, Robt.	1 C	Belfast.
McLaren, John	2 C	London

May 14th, 1881.

Clanahan, John	1 C	Lvrpool.
Elliott, George	2 C	Belfast.
Hepburn, Robert	1 C	Lvrpool.
McMillan, James	2 C	do.
Martin, Harold S.	2 C	London.
Mackintosh, David D.	1 C	Lvrpool.
Pearce, Martin	1 C	S Shlds.
Paterson, George	2 C	London.
Robertson, Alex.	2 C	do.
Robinson, Joseph D.	2 C	Lvrpool.
Westland, Wm.	1 C	London.

May 23rd, 1881.

Boag, John	2 C	Grnock.
Crawford, Donald	2 C	do.
Carr, William	1 C	N Shlds.
Dickson, William	1 C	do.
Dalgarno, Henry A.	2 C	Grnock.
Dempster, James	2 C	do.
Erickson, Erick A.	1 C	N Shlds.
Earnshaw, Thos.	2 C	London.
Fallan, John	2 C	N Shlds.
Ferguson, John A.	2 C	Grnock.
Glen, William	1 C	N Shlds.
Garbutt, James	2 C	do.
Gladwell, Thomas D.	1 C	London.
Howie, Robert	2 C	Grnock.
Heron, T. M.	2 C	N Shlds.
Liddle, Jacob	2 C	do.
Livesey, Geo. F.	1 C	Lvrpool.
Mackey, William	1 C	N Shlds.
Martyn, Richd. I.	2 C	do.
Mosley, Wm. F.	2 C	do.
McCallum, John	1 C	Lvrpool.
Morton, Richard	2 C	London.
Naylor, James	1 C	N Shlds.
Richards, Noel H.	1 C	do.
Rogers, Alfred	1 C	Bristol.
Ruddock, Robert T.	2 C	Grnock.
Smith, James	2 C	Aberdn.
Shaw, Jos. B.	1 C	London.
Scott, John	2 C	N Shlds.
Stevens, David	1 C	do.
Simpson, Jas. W.	1 C	do.
Thompson, James	2 C	do.
Tresize, Walter K.	2 C	do.
Wilson, Wm. B.	1 C	Aberdn.
Wainford, Hy. K.	1 C	Lvrpool.
Watt, Robert	1 C	do.

ROBERT JACKSON, Registrar-General.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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The Marine Engineer.

LONDON, JULY 1, 1881.

EDITORIAL NOTES.

THIS month has witnessed the launch of one of the most novel and striking additions to our Navy. We speak of the *Polyphemus*. This vessel we have already frequently referred to in its course of construction, and a detailed description of it will be found elsewhere. The rapid and grotesque modifications in the shape and armament of modern war-vessels must be perplexing in the extreme to the old school of sea-men. We should imagine that the modern monsters can be anything but pleasing to those who have such a vivid remembrance of England's old "wooden walls" that walked the waters like things of life. The present mastless iron-clads, of which the *Polyphemus* seems the ultimate absurdity, can only be compared to gigantic lizards or reptiles crawling almost immersed on the surface of the deep. There is, however, a diabolical intentness and determination for mischief about the *Polyphemus* that warrants remark. It will be a bold crew that ships aboard her in time of war. She is formed but to rush upon the foe with resistless speed and force, and to destroy her opponent or be herself destroyed in the attempt. She is provided with no guns, so there can be no dilly-dallying at long or even short ranges. Such play would be destruction to her as she cannot reply; but must at once rush in and decide the contest. At present, she would seem to have somewhat the advantage as against any present iron-clad, as she is considered shot-proof from the obliquity of her angles. We cannot but think, however, that some means to stay the rush of such a marine-destroyer will shortly be found, now that the monster himself is in evidence. It has been whispered that a small and rapid boat, provided with dymanite or torpedoes would prove amply efficient to bell this cat. Or a boarding party, after the Gatling guns and their turrets have been disabled by a few well-directed shots, could not be easily got rid of, and might soon effect an entrance. One of the signs of the times, however, is the happy dispatch in marine warfare to which we are more and more rapidly approaching.

THE launch of the *City of Rome* at the Barrow Shipbuilding Works was the scene of a serious boiler explosion, by which four men unfortunately met their death. It is incredible that such carelessness in the use of steam can exist amongst men who have any acquaintance whatever with steam boilers. A man who is said to have had considerable experience is stated to have allowed the pressure on his boiler to rise to 70 lbs., instead of keeping it at the proper working pressure of 40 lbs. If the boiler was provided with proper safety valves, it is not easy to imagine how such an excess pressure could have arisen, unless by jamming down the valves. In that case the criminal wilfulness and disregard of danger is equally difficult to believe. It seems to us that there will be no protection against such loss of life from explosions until all boilers are so fitted with lock-up safety valves that they cannot be tampered with, and also with low water alarms, so as to protect the boiler against the apparently wilful tampering and astounding negligence of the attendant. The only other protection in such cases is for the attendance upon boilers to be looked upon as an art or business requiring proper attention and training. We certainly fail to see why a boiler with all its possible powers of destruction should be considered a less important charge than an engine; and yet we see the former often in charge of an ignorant labourer, whilst the latter is given into the care of an intelligent artizan, whose whole life has been devoted to learning the duties of such a charge.

MESSRS. SAMUDA BROS. have just launched from their yard a novelty in mechanical appliances. It consists of a floating derrick or crane, capable of lifting a load up to 30 tons to a height of 60 ft. above the water. The crane can traverse a circle of 47 ft. radius, and is driven for lifting and rotation by engines under the control of a single man. The vessel is 100 ft. long, and 44 ft. broad, and the crane is 70 ft. high. This floating crane may probably effect a great improvement in the facilities for transporting heavy weights from craft to craft, or from the quay to a ship's hold with greater celerity and efficiency than can be done with a fixed derrick. For masting or dismasting vessels, or for repairing or replacing heavy boilers or machinery, this floating crane will prove eminently serviceable. It has been designed, and the crane and machinery constructed, by Messrs. Hunter & English for the London and Saint Katherine's Dock Company for use in their New Royal Albert and Victoria Docks.

A GOOD deal of atttention is now being paid to the subject of salvage by raising sunken vessels. The field for profit must be enormous, as many millions per annum are sunk by collision or foundering in comparatively shallow water. The only difficulties to deal with are the mechanical ones attaching to the difficulty of raising such heavy weights as the hulls of vessels without injury to them by the very lifting strain. The method which seems to be the most practically successful is to first stop all the leaks and hatches, and then pump the vessel empty. She will in such case rise by her own lightened weight, and float naturally. The chief difficulty experienced under these circumstances is the proper closing of the leaks and hatches by the divers. If this cannot be done the only alternative is to lift by grappling chains, and the proper attachment or under-laying of these form the chief obstacle to success. There is, however, little doubt that a few years' experience of different systems will at last develop a variety of successful methods, one or other of which may be relied on to raise any vessel from moderate depths, which is not too badly destroyed. This should be a great saving to the nation annually, as much valuable property lies wasting and rotting around our coasts. We see the Liverpool Salvage Association has successfully raised a steamer, sunk by a collision at the mouth of the Mersey.

EXPERIMENTING with torpedoes is expensive work, as each costs about £300. We see that one was lost the other day in the river, and that boats are occupied in dredging and searching for it. This torpedo is of either a secretive or adventurous disposition. It has disappeared and left no trace. It is not known whether it has buried itself in the Thames mud or whether it has gone to sea on its travels. It is to be hoped that it was not primed with its destructive charge, or it would be an unpleasant traveller to meet in its wanderings. We should suggest that if the torpedoes, like pet mice, are given to wandering, a clue should be retained as to their movements and whereabouts by means of a stout cord attached to their tails.

THERE is little doubt that electric lighting will shortly be generally used on board our ironclads. The difficulty has hitherto been the sufficient and simple subdivision of the light for the smaller cabins and state-rooms. This has now been attained on the incandescent system by Mr. Swan, and we see that his plan of lighting has been successfully applied to the cabins and 'tween decks of the *Inflexible*. The lights are of not greater brilliance than an ordinary gas jet, viz., about 16 candles each, and are, therefore, in every way suitable for small and confined situations. The admiral's and captain's cabins were lighted by two series of 48 lights, and the main deck, containing the ward-room and officers' cabins, by three series of 72 lights. The port, ammunition and other passages were also illuminated with a series of lights, and the whole were driven from a single circuit. The result of the experiment was highly gratifying to the inventor, as he had never driven so many lights from a single circuit before. The lights were suspended from wires about a yard apart.

MEETING OF SEA-GOING ENGINEERS.—On Wednesday night, June 1st, a meeting of sea-going Engineers was held in the office of Mr. W. J. Watson, Norfolk-street, Sunderland, for the purpose of forming an association similar to the British Shipmasters' and Officers' Protection Society. Mr. W. J. Watson presided, and Captain J. Henderson, Secretary of the British Shipmasters' and Officers' Protection Society, was also present. There was only a small attendance of sea-going Engineers. The Chairman said all those things had very small beginnings. The first meeting of the Shipmasters' Society was only attended by 8 or 10 persons, and the second by about 20. It now numbered about 2,000 members. The Board of Trade having directed their attention to sea-going Engineers, he thought it was absolutely necessary that they should form a society to protect themselves. They were a large and influential body of men, and ought to take some interest in their own welfare. There were about 2,000 Engineers going to sea, and they had no society to protect themselves. He thought it wou'd be for their own interests to form a society similar to the Shipmasters' Society. They had also a widows' and orphans' fund, so that the surplus money came back to the members in case of death. His object in calling the meeting was to raise discussion. He thought it would be advisable to get a committee formed, and go a little further into the subject, and have it further discussed at some future time. A desultory conversation ensued, and it was stated that the Engineers had already two associations, the Sea-going Engineers' Association and the Amalgamated Society of Engineers. The objects of these societies were similar to those proposed by the chairman. They had funds for giving compensation for loss of clothes, injuries, and funerals. The chairman said he was not aware, until that evening, that such societies were in existence, and, therefore, it was not necessary to take any further action in the matter. The meeting then concluded.

THE PREVENTION OF FOULING IN IRON SHIPS.—The prevention of fouling in the hulls of iron ships is a matter that has long engaged the attention of those interested in the construction and equipment of iron vessels. Many methods have been tried in order to protect vessels against the growth of barnacles in tropical waters, but it can scarcely be said that any of these have proved entirely successful. At present, ships require to be periodically docked and cleaned, and this entails not only a loss of time, but considerable expense. Much interest is therefore taken in a new ship which was launched from the shipbuilding-yard of Messrs. T. B. Seath & Co., Rutherglen. This vessel, which is named the *Bessie*, is built from designs by Mr. G. L. Watson, naval architect, for Mr. John Clarke, Paisley, and is intended as a tender for the yacht *Condor*. The novelty about the *Bessie* is that it is covered over the hull, to six inches above the water line, with a plate of zinc, and by means of this it is believed that the vessel will be thoroughly proof against fouling. The thickness of zinc employed is not great, and it is fitted so closely as not to interfere in the slightest with the delicate outlines of the vessel, but its thickness is sufficient to last, it is calculated, for fully six years. The patentees of this system are Mr. J. Jepson Atkinson, barrister, and Mr. C. F. Henwood, naval architect, of the Middle Temple, London. The well-known action of iron on zinc in salt water led to the discovery of this invention ; but while the use of zinc was well known, the difficulty of attaching it to the hulls of ships remained. Mr. Atkinson and Mr. Henwood have completely overcome this difficulty, and there can be no doubt that the use of their system will be watched with much interest by the shipping community. The method employed in fixing the zinc is simple and effective. The zinc sheets are attached to the iron plating of the vessel at spots nine to twelve inches apart, and at these spots a mechanical joint is made by an alloy or solder, the surface of the spots being about an inch and a-half square. The method of attachment causes the zinc to act like copper on the bottom of a wooden ship. Zinc in the ordinary seaway coming in contact with iron oxidises to the extent of about two to three ounces per square foot in a year, but by attaching zinc of sufficient thickness the vessel can be kept at sea for several years without docking, cleaning, or painting. Scraping will not be required, and the speed of the ship will not be diminished by the growth of barnacles. Mr. H. N. Moseley, of the University of London, has expressed himself satisfied with the chemical action of the new process, and there can be no doubt that the invention will, if successful, be of immense importance to shipowners. The career of the vessel will consequently be watched with great interest.

H.M.S. POLYPHEMUS.

On Wednesday afternoon, June 15th, at 10 minutes before 3 o'clock, there was successfully launched from the Royal Dockyard at Chatham one of the most remarkable examples, if not the most remarkable example, of naval architecture ever floated in connexion with naval warfare. This vessel is the double-screw steel armour-plated torpedo-ram *Polyphemus*, the construction of which was commenced on the 21st of September, 1878. The chief mission of the *Polyphemus* will be to act as a ram and torpedo vessel, and with this work in view most of the considerations which obtain in other ships of war have been set aside—safety and speed, of course, excepted, although the thinness of her armour would at the first glance lead to the conclusion that even safety has been neglected. This, however, is not so, as will presently be seen. It is to be borne in mind that the *Polyphemus* is, after all, only an experimental vessel, embodying the most practical and advanced ideas of those who advocate the principle upon which her design has been based. For the design the country is indebted to Mr. R. Barnaby, C.B., Director of Naval Construction, who has worked out every detail, keeping the object in view, as above stated, steadily in mind. It is quite possible that exceptions may be taken by some to this vessel, but it should be borne in mind that this, like all other departures from the beaten track in naval construction, is but an experiment, although a big and an essentially practical one. There is, however, no way by which the Admiralty are able to demonstrate a principle, except by construction on the actual scale required by practice. Anything short of this would be practically valueless.

The hull proper—that is to say, the iron and steel construction—of the *Polyphemus* resembles somewhat that of the once celebrated *Winaus* cigar-ship—that is to say, she is more or less pointed at the ends, while her midship section approaches the circular ; more nearly, however, resembling an ordinary ship with an arched deck. Upon this structure is mounted a superstructure of iron and timber, consisting of a main deck running fore and aft, and above it a hurricane deck. At intervals along the sides of the hurricane deck will be placed six turrets—three on either side—which will carry the heaviest class of Nordenfelt guns. Protruding upwards through this deck are two protected conning towers, one at each end, which are rigidly connected with the main structure of the vessel, and which form means of ingress and egress to and from her interior. There are also two ventilators and a smoke funnel, which are likewise connected with the main body of the ship. The superstructure itself may all be shot away without in any way injuring the vessel proper or impairing her powers, save only as regards the Nordenfelt guns. The steam steering apparatus is placed below, over the after boiler room, and the steering room is in telegraphic communication with the forward conning tower. The steering apparatus can, however, be actuated from the conning tower by manual gear which is fitted therein. As the *Polyphemus* carries no canvas, masts are dispensed with, and beyond a flag-staff or two nothing will appear above her decks but the towers, the ventilators, and the funnel. She will be propelled by twin screws, which are carried in framings, one on either side near her stern. These screws are three-bladed, 14 ft. in diameter, from 15 ft. to 17 ft. pitch, and with a blade surface in each screw of 45 ft. She is also fitted with two rudders, which are placed under her hull near her bows, and can be lowered for use and raised again into recesses in which they are ordinarily carried. They are intended to be used for special manœuvring purposes. The ram projects some 14 ft. beyond the body of the vessel, and is made hollow for the discharge of Whitehead torpedoes. The port or opening is covered by a solid steel cap, which forms the ram-point, but which, by means of a twisted sliding bar, can be easily pushed forward and turned up to allow of the discharge of the torpedo some 8 ft. below water-level, and is as easily closed afterwards. Besides this, there are four other torpedo ports for the discharge of the same class of weapon, two being placed on either side of the vessel near the bows. She will also carry spar or deck torpedoes.

The framing of the *Polyphemus* is of Landore-Siemens steel, over which is a double layer of ½-inch plates of the same material. Upon this, again, is superimposed a plating of Whitworth fluid compressed steel, the plates measuring 10 ft. long by 2 ft. 6 in. deep and 1 in. thick. Her outer armour consists of small plates or scales, also of Whitworth compressed steel, measuring 10 in. square by 1 in. thick, running off to ¾ in. at the ends. The plates are fastened on by five screws, one at each corner, which holds three other plates, and one in the centre. This plating covers her curved deck and extends a short distance down below water level. The vessel measures 240 ft. long between perpendiculars, and has an extreme breadth of 40 ft., with a depth of hold of 18 ft. 9 in.

Her immersed midship section is 625 square feet, and she draws 19 ft. 6 in. of water forward and 20 ft. 6 in. aft, her displacement load being 2,640 tons. Her engines, which are by Messrs. Humphrys, Tennant & Co., are of the compound, horizontal, single piston-rod type, having four cylinders, the two high-pressure being 38 inches in diameter, and the two low-pressure 64 inches in diameter, with a 39-inch stroke. Her indicated horse power is 5,500, and her estimated *maximum* speed 17 knots. Steam will be supplied from 10 boilers of the locomotive type, at a working pressure of 120 lb. per square inch, they having been tested to double that pressure—viz., 240 lb. per square inch. The air-compressing machinery for the torpedoes and the steam steering apparatus are by Mr. Peter Brotherhood. The weight of the machinery, inclusive of the water in the boilers and 10 tons of spare gear, is 490 tons.

Such is the *Polyphemus*, the most recent addition to the Royal Navy, which, in spite of her peculiar construction, will not, when finished, by any means present an unsightly appearance afloat, but rather the contrary. Although carrying no heavy guns, her offensive powers will be very great as a ram and a torpedo craft, while her ability to manœuvre rapidly and to move at great speed, combined with her peculiar outward form, which presents a variety of oblique angles to the enemy's shot, form her chief means of defence. Should she, however, receive a shot she will not be in imminent danger, as she is divided into a great number of water-tight compartments. From the nature of her construction she will have to be for the most part artificially lighted below, while air will also have to be artificially supplied to her, so that her crew, who will number 130, will not, perhaps, have the most enviable life while she is in commission. But with all this she forms a most formidable addition to our Navy, and one, moreover, the stability of which is perfectly assured.

The launch of this interesting vessel took place with punctuality. After the customary religious service by the chaplain, the christening ceremony was performed and the launch practically effected by Mrs. G. O. Trevelyan, wife of the Secretary to the Admiralty. By simply pushing forward a lever that lady released the dog-shores and at the same time actuated a piece of mechanism by which the traditional bottle of wine was dashed against the bows of the vessel, which were wreathed with flowers. With an uttered good wish from Mrs. Trevelyan, the *Polyphemus* glided down her ways into the river amid the plaudits of the spectators, who had assembled to the number of several thousands, and the strains of the National Anthem, played by the band of the Royal Marines, which was in attendance. There was a large and distinguished company present upon the platform, which included Admiral Sir George Sartorius, Admiral Sir Houston Stewart; the Admiral-Superintendent, Admiral Brandreth; the Colonel Commandant of Marines, Colonel Connolly; the chief officials of the Admiralty and of the Dockyard; Lord Randolph Churchill, M.P.; Mr. Gorst, Q.C., M.P., the local member, and Miss Gorst; Mr. Brassey, M.P., Mr. P. Stewart Macliver, M.P., and Captain J. W. Gambier, R.N. The naval representatives of the various foreign Governments were also present. The vessel was built and launched under the superintendence of Mr. R. P. Saunders, chief constructor of the dockyard, and Mr. Penny, the senior foreman in charge. The *Polyphemus* was launched with her engines on board, and will be taken into dock and got ready for her steam trials, which will be carried out at an early date, and which are looked forward to with general interest.

LAUNCH OF THE "CITY OF ROME."

THE Barrow Shipbuilding Company launched from their yard on June 14th the steamer *City of Rome*, which has been built to the order of the Inman Line, and intended for the Liverpool and New York station. As this steamer is the largest in the world after the Great Eastern, much interest was taken in the launch, which passed off very successfully, Lady Constance Stanley performing the ceremony of "christening." We gave an account, with illustrations, of the *City of Rome* last year (*vide* September number), but it will be convenient that we should give some particulars concerning the vessel here. The *City of Rome* is the seventy-seventh vessel constructed by the company. Amongst these may be named, s.s. *Duke of Devonshire*, 3 000 tons, launched June 25th, 1873; s.s. *Duke of Buccleuch*, 3,000 tons, launched October 9th, 1873; s.s. *Duke of Lancaster*, 3,000 tons, launched April 16th, 1874; s.s. *Anchoria*, 4,170 tons, launched October 23rd, 1874; s.s. *Devonia*, 4,270 tons, launched March 28th, 1877; s.s. *Circassia*, 4,270 tons, launched March 19th, 1878; s.s. *Belgenland*, 3,692 tons, launched December 24th, 1878; s.s. *Rhynland*, 3,689 tons, launched March 10th, 1879; s.s. *Furnessia*, 5,500 tons, launched October 19th, 1880; &c. The following are the dimensions:—Length over all, 610 ft, length between perpendiculars, 586 ft., extreme, breadth 52 ft. 3 in., depth of hold, 37 ft., tonnage, 8826 tons, indicated horse power, 10,000. It was stipulated that the vessel should combine the highest rate with the maximum of comfort and conveniences, such as are only to be found in the best modern hotels. The distinctive type of the Inman Line has not been departed from in respect of the perhaps old-fashioned, but still handsome profile, with clipper bow, figurehead and bowsprit. The figurehead is a full length figure of one of the Cæsars in the imperial purple. The whole of the headwork with this exception is formed of iron, to save the cost and trouble of continually renewing the head-rails, &c., when made of wood. The vessel is to be rigged with four masts; and here again the handsome full ship rig of the Inman Line has been adhered to with the addition of the fore and aft rigged jigger mast, rendered necessary by the enormous length of the vessel. She will have three funnels, each painted with the company's white band. A point calling for special notice is the large number of separate compartments formed by water-tight bulkheads, each extending to the main deck. The largest of these compartments are only about 60 ft. long; and supposing that, from collision or other cause, one of these were filled with water, the trim of the vessel would not be materially affected. The Mersey frame or post made at the Mersey Iron and Steel Works, is the largest single forging ever made for such a purpose; the finished weight is no less than 33 tons, as compared with 18 tons in the sternpost of the *Furnessia* of 5,500 tons. The framing of the vessel is of the ordinary type, the floors being 34 in. deep at the centre line. There are two complete, while the lower deck is complete for half the length, and has wide plating on each side for the remainder. The question of propelling this great vessel at so high a speed, namely, 18 knots per hour, was one that demanded long and careful consideration. It was ultimately decided that it would be better to adhere to the single-screw arrangement, and to adapt a propeller 24 ft. in diameter, driven by three sets of inverted "tandem" engines, working on three cranks disposed at an angle of 120 deg. with one another. The "tandem" engine has the high-pressure cylinder placed in a line behind or above the low-pressure cylinder. Each high-pressure cylinder is carried upon three wrought-iron columns, thus giving plenty of light, and easy of access to the stuffing-boxes; and also enabling the cylinder covers, which are made in halves, to be readily withdrawn. The slide valves are driven by an independent shaft, worked by two pairs of mortice wheels, one at each end of the engines, an arrangement which has the advantage of requiring comparatively small eccentrics. The crankshaft is a built shaft, and together with the screw shafting has been made by Sir Joseph Whitworth & Co., of their fluid compressed steel. The shafting is made hollow, and by the following process: Each length is made from a hollow cylindrical ingot, which, while in the molten state, is subjected to a heavy hydraulic pressure. The ingot is afterwards reheated and placed on a mandrel and is then forged and drawn by hydraulic pressure, until it ultimately assumes the form of a double collared shaft. The leading particulars of the engines are as follows:—

There are three high-pressure cylinders 43 in. in diameter and three low-pressure cylinders 86 in. in diameter, and 6 ft. stroke. The diameter of the crankshaft is 25 in., and of the crankpins 26 in. The length of the main bearings is 33½ in., and of the crankpins 28 in. The crankshaft, as built up complete, will weigh 64 tons; had it been made of iron and solid, the weight would have been 73 tons. The propeller shafting is 24 in. in diameter, and the hole through it 14 in. in diameter. The thrust shaft has thirteen collars, 39½ in. in diameter, giving a surface of 6,000 square inches. This piece of shafting weighs 17 tons. The propeller shaft is 25 in. in diameter, and 30½ ft. long, and weighs 18 tons. The engine bedplate weighs 100 tons. The cooling surface of the condensers is 17,000 square ft., equal to nearly 17 miles 360 yards of tubing. There are two air-pumps, 39 in. in diameter, and 3 ft. stroke; these pumps, and the feed and bilge pumps, being worked by levers attached to the aft and forward engines. There will also be a large centrifugal pumping engine, which can either be used for pumping heavy leaks, or to discharge through the condenser. There will also be three auxiliary pumping engines, for feeding the boilers, for bilge pumping and for deck purposes. Steam will be supplied by eight cylindrical tubular boilers, fired from both ends. Each boiler is 14 ft. mean diameter, and 19 ft. long, with a steam receiver 13 ft. long and 4 ft. in diameter, and has six furnaces 3 ft. 9 in. in diameter, three at each end, so that there are forty-eight furnaces in all. The firebars are 6 ft. long, giving a grate surface of 1,080 square ft. The shell plates of the boilers, supplied by Sir John Brown & Co., are 24 ft. 8 in. long, 4 ft. $4\frac{1}{2}$ in. wide, and $1\frac{1}{4}$ in. thick, and weigh nearly $2\frac{1}{2}$ tons each; all the holes are drilled. The internal parts are of Bowling iron, and each furnace has its own separate combustion chamber. These boilers are constructed for a working pressure of 90 lb. per square inch. The engines are intended to work constantly at 8,000 indicated horse power, although they are capable of developing 10 000 horse power indicated.

The internal arrangements for the comfort and convenience of the officers, crew, and passengers of the huge floating palace are to be of the most elaborate description. There are two large smoking-rooms, which will be highly decorated and fitted up in the most approved style, each saloon having a separate entrance. In the after deck-house there is a commodious saloon, which is to be furnished in the most elegant manner as a lounge for ladies. The upper saloon, or drawing-room for the use of passengers, is a handsome apartment in the form of a wide gallery with lounges round the sides and a large rectangular opening into the dining-room below. Above this opening is a large skylight richly ornamented. At the fore end of this saloon will be placed a grand piano, and at the after end is the staircase leading to the dining-room. The estimated weight of the vessel complete and ready for sea is 8,000 tons, and her displacement at 26 ft. mean draught is 135,000 tons, so that she will have a dead weight of carrying power of 5,500 tons. The cubical contents of her hold will give her a measurement capacity of 7,720 tons at 50 cubic feet to the ton.

Arrangements which were made to secure the successful launching of this vessel are not without interest. Heavy cable chains were suspended from both port and starboard bow, and held in festoons by means of Manilla ropes to about amidships. Here the cable dropped into the yard, and was coiled to the extent of several fathoms, being ultimately connected with large anchors, which were sunk in the earth. Round the upper hook of the anchor several fathoms of heavy cable were placed. Behind this about 25 tons of cable were placed, and in the rear again about 25 tons of iron girders, built in a box, in order to form a drag. When the ship had left her ways and travelled in the water 20 ft., she was checked by the two anchors in the yard, and when she had dragged these 25 yards further, 50 tons of chain were added to the drag, and at a further distance of 25 ft. another 50 tons of iron in a second box as referred to were brought to bear in the work of checking the steamer. The anchors were dragged 300 ft. before the ship was brought to, but of course the anchors on shore were greatly aided by the two other anchors, which were thrown overboard so soon as the ship was afloat. The *City of Rome* was taken in tow by tug-boats in the Channel, and docked in the Ramsden dock. She was afterwards brought through the Buccleuch dock into the Devonshire dock under the 100-ton crane, where she will receive her boiler engines and other fittings. She is expected to be on her station early in October.

Sir James Ramsden, managing director of the Barrow Shipbuilding Company, presided at the luncheon, at which there were between 200 and 300 guests. He apologized for the absence of the Duke of Devonshire, chairman of the Shipbuilding Company, and then proposed the toast of the day, "Success to the *City of Rome* and the Inman Steamship Company." He referred to the enterprise the Inman Company had shown in ordering the largest steamer in the world, commercially speaking. Mr. Charles Inman, representing the owners, responded, and Mr. Ernest Inman proposed, "The Barrow Shipbuilding Company," to which Mr. J. Fell and Colonel Stanley, M.P., responded. Colonel Stanley said he did not know whether we were going, as Mr. Scott Russell had said, to jump at once to building another Great Eastern, but there was certainly a progressive increase of the size in which ships were being built, and the *City of Rome*, which he hoped would be successful, was the latest instance in point. It may be stated that the Barrow Shipbuilding Company have now on hand two steamers for a French company of 4,000 tons each, two steel steamers for the Peninsular and Oriental Company of 3,600 tons each, two for the Ducal Line of 3,500 tons each, two for the Anchor Line of 3,050 tons each, together with other smaller craft.

It is much to be regretted that a fatal boiler explosion occurred on the *City of Rome* shortly before the launch. The boiler which exploded was a vertical tubular boiler which had been fixed on the deck in connection with a donkey engine for hoisting purposes, and it was not far from the platform which had been erected in the bow of the vessel and on which a number of the invited guests were standing. Fortunately none of these were injured, but four men were killed and six injured.

THE RELATIVE CORROSION OF IRON AND STEEL.*

By Mr. William Parker, Chief Engineer-Surveyor of Lloyd's Register, London.

A FEW weeks ago I had the honour to read a paper before a kindred society—the Institution of Naval Architects—on some peculiarities in the behaviour of steel, which had come under my observation, bearing chiefly upon its qualities of uniformity and ductility. On the present occasion I desire to deal with an entirely different branch of the subject—namely, that relating to its power to withstand corrosion, chiefly in connection with marine boilers and in comparison with iron. When mild steel was first introduced, a few years ago, two questions were prominently discussed; one was its reliability as a constructive material, the other was its durability so far as corrosion, under different conditions of employment, was concerned. The only experience which had been obtained with steel in these directions up to that time was with a different quality of the material to that used in the present day, and it was sufficiently various and contradictory to give rise to much disagreement and no little speculation. This, although it retarded the introduction of mild steel, was in one sense an advantage, for it gave rise to extensive experiments which, while they could not entirely set these questions at rest, at least tended to throw light on the peculiarities of the metal, and hence to lead to its more intelligent manipulation and preservation.

Among the earliest important attempts to deal with the question of corrosion in recent years were the investigations of the late Admiralty Boiler Committee. It is not too much to say that the investigations of that Committee were eagerly looked for by all interested in the subject. The results have been for some time before the public, and have given rise to much discussion. On the surface, they appeared decidedly unfavourable to steel, and deductions have been made from them which are to my mind, open to exception. I have therefore thought that a brief analysis of the methods adopted in conducting the experiments wonld be not only interesting, but that, in view of the prominence accorded to those experiments, it is almost called for at the present time. It will be seen, on looking into the experiments conducted by this committee, that in most of the vertical tubes in which the plates were experimented upon in boiling water (with or without air) there was a copper plate present, and in many instances the different iron and steel plates were held in position by brass or copper rods, while no precautions had been taken to insulate them. Moreover, all the steel plates had been fixed above the iron ones, and as the temperature was greater in the upper than in the lower parts of the tubes, it might have been expected, other things being equal, that the steel would corrode faster than the iron. It could not be said, therefore, that the results of the investigations of the Boiler Committee had settled the question of corrosion, and we were induced to look again to the limited experience that existed, and to the comprehensive experiments made about forty years ago by Mr. Robert Mallet for the British Association. These experiments were on chilled and "green sand" cast irons made by hot and cold blast, or hammered and rolled cast, blister, shear, and spring steels; hammered and rolled wrought iron, including Swedish, Lowmoor, and many ordinary sorts of iron, down to puddled bars.

The value of Mr. Mallet's Paper on these experiments is diminished by the fact that the scale was left on the cast iron in nearly every case, while it is not definitely stated whether it was removed from the wrought iron; but the experiments are nevertheless extremely interesting, and a feature worth notice in them is the appended analyses and densities of some of the materials experimented upon. It may be mentioned that the square plates experimented upon were fixed with their four corners to wooden frames and placed in wooden boxes. The complete results of the experiments will be found in the Transactions of the British Association for the years 1838, 1840, and 1843. The losses by corrosion are given in these tables in grains per square inch, per 732 days, and they can be readily compared with the results of some experiments to be described hereafter, as they are nearly a hundred times greater than if they had been given on the scale I have adopted, which is in pounds per square foot per annum. Comparing the mean losses given by Mr. Mallet of the ordinary sorts of iron with those of Swedish and Lowmoor iron, a difference in favour of the last two is observed when exposed to river-water and to fresh sea-water, while the latter irons compare unfavourably with the common irons when subject to the atmosphere or to what he calls "foul sea-water." The specific gravity stands in close relation to the amount of corrosion, it being found that in all the different classes of material, whether chilled or "green" cast iron, steel, or wrought iron, the heaviest metal of each description lost less than the lightest one. The analyses, of which a full description is appended to the report, show also beyond doubt that the greater the amount of combined carbon (found by combustion), and perhaps silicon, the less was the corrosion. The manganese, which was present in very small quantities, has played such a subordinate part that its effect cannot be traced. These are, so far as I can gather, the principle conclusions to be drawn from Mr. Mallet's paper, although he was of opinion that the finer the quality of the iron the less it will corrode.

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* Read at the Spring Meeting of the Iron and Steel Institute.

These conclusions, if correct, would be an important addition to our knowledge, but they scarcely accord with the results of experience, and, as I have pointed out, we are at once met by the difficulty that in the case of Mr. Mallet's experiments, we are left in doubt whether the scale was removed or not; and in the case of the boiler committee we are left in doubt how far the want of insulation may have affected the results; and there is the further difficulty in comparing the two sets of experiments, that those of Mr. Mallet were only made in low temperatures and those of the Boiler Committee in high ones. It was shortly after the issue of the first report of the Boiler Committee that I commenced to investigate the subject for the committee of Lloyd's Register of Shipping, and I then endeavoured to arrange the series of experiments I am about to describe so as to avoid as far as possible the sources of error indicated above, and to show the effect of the absence as well as the presence of scale.

In the first place, I obtained twelve discs, 4½ inches diameter, and about ¼ in. thick, from each of the following manufacturers :—

Common iron from the Parkhead Forge Company, Glasgow.
Common iron from the Kerne Ironworks Company, Darlington.
Best quality iron from Lowmoor Iron Company.
" " Bowling Iron Company.
" " Farnley Iron Company.
" " Messrs. Taylor Brothers, Leeds.
" " Leeds Forge Company.
Mild Steel from Landore Steel Company.
" Bolton Iron and Steel Company.
" Messrs. John Brown & Co.
" Steel Company of Scotland.

Six of the discs from each maker were turned bright entirely to remove all scale, and the other six were turned round the edge only, so as to damage the scale as little as possible. Each disc was carefully weighed to $\frac{1}{50000}$ part of its own weight at the Royal Naval College, Greenwich, through the kindness of Professor Reinold. They were divided into six series, each containing twenty-two discs, one black and one bright, from each of the above-named works, and were fixed together by means of an iron rod which had been covered by a glass tube, the plates being separated from each other by means of glass ferrules about ¾ in. long and 1 in. in diameter, thus so far as possible insulating each disc, and preventing galvanic action being set up between them. I may mention that one of these sets of discs as insulated was immersed in sea-water, and it was found that by completing the circuit between any two of them a galvanic current was set up, the bright Lowmoor plate being electro positive to the whole of the other plates; and as it is impossible that the energy represented by the galvanic current could be generated without oxidation or corrosion of the metal, the necessity of thoroughly insulating the discs is evident.

One series (A) was suspended on the roof of a building in the City of London, exposed to the action of the atmosphere, from the 13th February, 1879, to 13th May, 1880, or 455 days. Another set (B) was securely fixed under water to the pier at Brighton from 24th February, 1879, to 7th May, 1880, or 437 days. A third series (C) was so secured to the engine-room floors of a ship trading to the East as to be freely exposed to the action of the bilge water from 9th June, 1879, to 6th February, 1880, or 240 days. The remaining three sets (D, E, and F) were hung up in the wide water-spaces between the tubes of marine boilers in such a manner that they could not swing about, and were always about 12 in. below the water-line. These boilers were each in different vessels, employed in different trades, and subjected to entirely different treatment. The vessel containing series D, belonging to the British India Company, was employed in the East Indian trade; zinc was used in these boilers and they were blown off as seldom as possible. The immersion lasted from the 15th February, 1879, to the 6th June, 1879, and from the 14th June, 1879, to 16th February, 1880, or 361 days.

In the steamer containing set E, owned by the Peninsular and Oriental Company, and engaged in the China trade, no zinc was in the boilers, which were blown out at each terminal port, and run up afresh with salt water. This series was exposed from the 15th February, 1879, to 6th June, 1879, and from 12th June, 1879, to 13th November, 1879, or 64 days. The remaining series (F) was exposed in the boiler of a steam-collier running between Newcastle and London from the 23rd May, 1876, to the 23rd April, 1880, or 336 days. No zinc was used in this boiler, and the water was taken from a point in the Tyne, where it is probable that the refuse from one of the local chemical works acidulates it considerably. The boiler was emptied once in ten weeks, and steam was kept up for four days out of every five. After the completion of the exposure the scale and rust were removed as carefully as possible by scraping and brushing the discs with a file card, and each one was again weighed at the Greenwich College with the same nicety as in the first place, and the results follow in a tabulated form.

(*To be Continued.*)

BOILER INCRUSTATION.

THE dangers and waste of fuel arising from the formation of Scale in Steam Boilers, are doubtless too well known to our readers to render necessary their recapitulation here; we may, however, refer to the annual reports of the Steam Boiler Insurance Companies, which contain collective evidence of the disastrous results to life and property, where scale or deposit is allowed to accumulate,* to say nothing of the waste of fuel and time lost in getting up steam. Some idea may be formed as to these last two items, from the fact that carefully conducted experiments show that even with a thin deposit of only $\frac{1}{16}$ of an inch, the presence of such an intervening non-conducting material between the boiler plates and the water, gives an average loss of 10 per cent in fuel. Now, of remedial agents proposed and introduced for the abatement of this great source of trouble to Steam users, the number indeed is almost "*legion*"; the subject is therefore one which we touch upon with extreme caution. Unfortunately many of the so called "remedies," which have been introduced and are still in the market, are mere quack specifics, launched by adventurers who are devoid of any practical knowledge of the important subject to be dealt with: we find too, that the circulars of several of these "nostrums" have the imposing prefix "Patent" unblushingly added, without a tittle of right to assume the privilege inferred by the use of that word. Not only so, but, in many cases "Boiler Fluids" or "Anti-Incrustators" are not only ineffectual, but positively injurious. We hold with the wholesome maxim, that "prevention is better than cure," and, that wherever a system of filtration or depositing can be adopted (such for instance as the process of the late Dr. Clarke, and more recently that known as the Porter-Clarke process,) this is preferable to "doctoring" the boiler. In many cases, however, there is no alternative but either to allow the deposit and formation of incrustation to go on until an opportunity occurs to scale or chip the boiler, or else to apply an antidote. A really good anti-incrustation composition being therefore a desideratum, we have been induced to enquire into the merits and actual results obtained by the use of a composition for this purpose which has been recently brought under our notice, namely, that manufactured, and supplied as a fluid, by Messrs. W. Allen & Co., of the Canteen Works, Vicarage Lane, Stratford, E., and which we find to be such as to justify our referring to here, especially as Messrs. Allen have evidently given the important subject of boiler incrustation most careful and exhaustive attention: they do not profess to prescribe an all round system of treatment, but, on learning the actual conditions as regards the nature of the deposit, the kind of water used, &c., they are prepared to guarantee a successful result for their remedy if used in accordance with their directions to meet the requirements of the case. Briefly, all that Messrs. Allen ask for, is a fair opportunity to demonstrate the efficiency of their invention, and to which therefore, we have pleasure in drawing the attention of our readers.

A NEW Iron Shipbuilding Company is about to be established at Blyth. Two large iron steamers are now building on the Tyne for an Italian firm.

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* We may specialize the valuable report of the Chief Engineer of the National Boiler Insurance Company for last year, which details instances of fracture and fatal explosions arising from such deposits.—ED. M.E.

THE INFLUENCE OF CUT-OFF AND LENGTH OF CONNECTING ROD ON THE WORKING OF STEAM-ENGINES.

By C. E. Stromeyer, Esq., Engineer Surveyor to Lloyd's Register.

[Read at the Twenty-Second Session of the Institution of Naval Architects, 7th April, 1881; the Right Hon. the Earl of Ravensworth, President, in the Chair.]

(*Continued from page* 58.)

If you imagine a turning moment to be acting on a weightless shaft to which a fly-wheel having a moment of inertia T has been fixed, it will produce an angular acceleration.

$$\theta = \frac{M}{T}.$$

If the same moment is made to act on a weightless crank shaft to which a connecting rod and piston having the combined mass (m) has been connected, it will produce a downward acceleration

$$\frac{M.}{m \, . \, r \, . \sin \alpha}$$

and an angular one

$$\theta_1 = \frac{M}{m \, . \, r^2 \sin \alpha^2}.$$

If θ and θ_1 are to be equal, then T must equal $m\,r^2 \sin \alpha^2$. By substituting the masses of piston and rods for the different engines, in equations showing the angular acceleration of a crank at any time or angle, the following equations will be the result: T_1 T_{11} and T_{111} are the inertia of imaginary fly-wheels—

Single Engine $$T_1 = r^2 \left[\left(m - \frac{I}{l^2} \right) \sin \alpha^2 + \frac{I}{l^2} \right].$$

Double Engine $$T_{11} = r^2 \left[\left(m_1 - \frac{I_1}{l_2} \right) \sin \alpha^2 + \left(m^2 - \frac{I^2}{l} \right) \cos \alpha^2 + \frac{I_1}{l^2} + \frac{I_2}{l^2} \right].$$

Treble Engines $$T_{111} = \left[\left(m_1 - \frac{I_1}{l^2} \right) \sin \alpha^2 + \left(m_2 - \frac{I_2}{l^2} + m_3 - \frac{I_3}{l^2} \right) \frac{1}{2} \cos \alpha^2 - \left(m_2 - \frac{I_2}{l^2} - m_3 + \frac{I_3}{l^2} \right) \sqrt{\frac{3}{4}} \cos \alpha . \sin \alpha + \frac{1}{4} (m_2 + m_3) + \frac{I_1}{l^2} + \frac{3}{4} \frac{I_2 + I_3}{l^2} \right].$$

If $m_1 = m_2 = m_3$ as before, then—

$$T_{11} = r^2 \left(m + \frac{I}{l^2} \right),$$

$$T_{111} = r^2 \frac{3}{2} \left(m + \frac{I}{l^2} \right).$$

which can be expressed as follows:—In double and treble engines the oscillating masses, if equal, act in the same way as a solid fly-wheel of an equal total weight, and having for diameter the length of the stroke. In single engines only a very small part of the total masses act as a fly-wheel. Therefore, the following tables, which have been compiled on the assumption that the oscillating masses produce no disturbing influences, will only be strictly applicable to the case of double and treble engines where the weights of the pistons and rods of the different engines are about equal, though they will no doubt be found of value in some of the other cases. The values were arrived at in the following manner: Let ψ represent the ratio of greatest increase or decrease of energy to the amount of work indicated per stroke, and η the coefficient of uniformity, then

$$\eta = \frac{\psi \times \text{work per stroke}}{T \times \omega^2},$$

and the inertia of fly-wheel $T = \frac{\psi}{\eta \, . \, n^3} \times 1{,}500{,}000 \times \text{I H P}.$

where n = number of revolutions per minute, η and every other value except ψ is known; to find this a great number of diagrams representing the turning moments of single, double, and treble engines, with six different grades of expansion and eleven different lengths of connecting rods, were drawn according to the following formula:—

$$\frac{d\,u}{d\,x} = h \left(1 + \frac{y}{x} \right),$$

$$M = P \, . \frac{d\,u}{d\,a} = P \, . \, h \left(1 + \frac{y}{x} \right).$$

Then the line of mean resistance was drawn through them, all the different areas above and below this line were measured, and the largest one divided by the area during one half-revolution, which is the required co-efficient ψ. To find Q, the weight of the fly-wheel, substitute the proper value of ψ out of the table into the following formula, where R = radius of fly-wheel and η co-efficient of uniformity.

$$Q_1 \text{ tons} = \frac{\psi}{\eta\, n^3} \times \frac{\text{I H P}}{R^2} \times 21600.$$

The weight of a solid fly-wheel is

$$Q_2 \text{ tons} = \frac{\psi}{\eta\, n^3} \times \frac{\text{I H P}}{s^2} \times 174400.$$

If, however, in a double or treble engine Q is equal to or less than the total weight of the pistons and rods, then no fly-wheel is necessary.

Looking at the Diagrams II., III., IV., of the value ψ which gives one an idea of the necessary weight of fly-wheel or revolving masses, it will be seen how very much smaller it is for the treble than for the double and single engines, and that it does not vary, as has been generally assumed, inversely as the grade of expansion, but that it increases at the same rate as the length of stroke while the connecting rod remains constant. In Diagram V. you will notice that the values diminish between the lines, representing a cut-off of about $\frac{1}{10}$ to $\frac{3}{10}$ stroke. This depression puzzled me greatly at first, but I found on looking at the diagrams that for the above cut-offs the maximum turning moment of one engine is exerted just when one of the other cranks is either at the top or bottom of stroke: the result is a very uniform diagram. The same thing occurs in double engines for a cut off of about $\frac{7}{10}$ stroke, which will explain the depression in Diagram IV. Looking at Diagrams IV. and V. it will be seen that the co-efficients of a double or treble engine, in which the ratio of $l : s$ is 1 : 1 and 2 : 1 respectively, are nearly identical for grades of expansion varying from $\frac{3}{10}$ to $\frac{6}{10}$, and that beyond these limits the treble engine has the advantage; it therefore appears strange that, except for centrifugal pumps, the three-cylinder engines which are now being constructed should have what appear to be long connecting-rods, especially as by lengthening the stroke at the expense of the diameter and other dimensions, the friction in the bottom end is reduced considerably.

In conclusion, I wish to say that as all the diagrams on which the calculations were based are theoretical ones, the results will never be absolutely in accordance with practice, but they give a very good idea of the influence of the two dimensions often referred to above, and will, I trust, facilitate the work of those who now and again have to go into this subject for new types of engines. Rounding off the corners of the diagrams will have the effect of levelling the lines, *i.e.*, increasing the small co-efficients and diminishing the large ones.

Summing up the results of all these calculations you obtain a few rough formulæ.

Weight of a solid fly-wheel the diameter of which equals the length of the stroke is Q.

Single Engines $$Q_1 = \text{I H P} \times \frac{75000}{\eta\, s^2 n^3} \left(.30 + \frac{s}{7\,l} - \frac{e}{10} \right)$$

Double Engines $$Q_2 = \text{I H P} \times \frac{75000}{\eta\, s^2 n^3} \left(.07 + \frac{s}{8\,l} - \frac{e}{8} \right)$$

Treble Engines $$Q_3 = \text{I H P} \times \frac{75000}{\eta\, s^2 n^3} \left(.055 \times \frac{s}{20\,l} - \frac{e}{20} \right)$$

$$\frac{s^2\, Q \times 2240}{8 \times 32{\cdot}2} = T.$$

The friction is approximately

Guide friction $= Fg = \text{I.HP.} \times \psi \times \frac{s}{l} \times {\cdot}40$

Crank or journal friction $= Fc. = \text{I.HP.} \times \psi \times \frac{d}{s} \times 1{\cdot}6$

TABLE I. *a.*—*Mean Normal Pressure on Guide Bar.*

Cut off / Stroke.	Connecting Rod ÷ Piston Stroke.									Mean Pressure. / Initial Pressure.
	∝ : 1	6 : 1	3 ÷ 1	2 ÷ 1	3 ÷ 2	6 ÷ 5	1 ÷ 1	6 ÷ 7	3 ÷ 4	
·1	0	·0557	·112	·170	·231	·295	·370	·451	·553	·33026
·2	0	·0613	·123	·187	·254	·324	·406	·497	·601	·52189
·3	0	·0637	·128	.194	·264	·338	·423	·516	·621	·66119
·4	0	·0648	·130	·198	·269	·345	·431	·525	·633	·76652
·5	0	·0652	·131	·200	·271	·348	·434	·529	·636	·84657
·6	0	·0651	·131	·199	·271	·348	·434	·528	·637	·90649
·7	0	·0645	·130	·198	·268	·346	·431	·526	·633	·94967
·8	0	·0639	·129	·195	·265	·342	·426	·520	·628	·97851
·9	0	·0635	·128	·194	·264	·339	·421	·517	·623	·99482
1·0	0	·0634	·128	·194	·264	·338	·420	·516	·622	1·00000
△	0	·0634	·128	·194	·264	·338	·420	·516	622	·50000
TABLE II. *a.*—*Mean Pressure on Crank-Pin.*										
·1	1·190	1·190	1·200	1·210	1·225	1·246	1·273	1·305	1·340	·33026
·2	1·060	1·060	1·067	1·074	1·088	1·107	1·130	1·165	1·203	·52189
·3	1·001	1·002	1·010	1·017	1·030	1·050	1·076	1·113	1·153	·66119
·4	·977	·978	·984	·993	1·009	1·029	1·058	1·094	1·137	·76652
·5	·969	·970	·976	·985	1·012	1·022	1·053	1·089	1·136	·84657
·6	·975	·976	·980	·990	1·004	1·026	1·058	1·092	1·138	·90649
·7	·983	·985	·989	1·000	1·013	1·033	1·064	1·098	1·144	·94967
·8	·992	·994	·988	1·009	1·020	1·040	1·070	1·104	1·148	·97851
·9	·998	1·000	1·005	1·015	1·026	1·046	1·073	1·109	1·151	·99482
1·0	1·000	1·002	1·008	1·018	1·030	1·050	1·075	1·110	1·152	1·00000
△	1·000	1·001	1·006	1·018	1·036	1·060	1·091	1·128	1·173	·50000
Mean Pressure. / Initial Pressure.	TABLE I. *b.*—*Mean Normal Pressure on Guide Bar.*									
·1	0	·048	·093	·141	190	·244	·299	·367	·448	·1
·2	0	·052	·104	·156	·209	·270	·335	·409	·500	·2
·3	0	·056	·111	·167	·227	·290	·364	·443	·543	·3
·4	0	·058	·116	·178	·240	·308	·387	·470	·575	·4
·5	0	·060	·121	·186	·253	·321	·404	·492	·598	·5
·6	0	·063	·127	·191	·260	·333	·418	·508	·614	·6
·7	0	·064	·130	·196	·267	·342	·428	·520	·628	·7
·8	0	·065	·131	·199	·270	·348	·433	·527	·635	·8
·9	0	·065	·131	·198	·270	·348	·430	·528	·637	·9
1·0	0	·063	·128	·194	·264	·338	·420	·516	·622	1·0
△	0	·063	·128	·194	·264	·348	·420	·516	·622	·5
TABLE II. *b.*—*Mean Pressure on Crank Pin.*										
3	1·218	1·218	1·227	1·237	1·255	1·278	1·306	1·334	1·372	·3
4	1·135	1·135	1·143	1·153	1·168	1·185	1·210	1·240	1·279	·4
5	1·073	1·073	1·078	1·087	1·100	1·118	1·143	1·176	1·213	·5
6	1·024	1·025	1·032	1·040	1·052	1·070	1·096	1·031	1·171	·6
7	·991	·992	·999	1·008	1·024	1·040	1·067	1·104	1·146	·7
8	·971	·972	·980	·988	1·004	1·024	1·054	1·090	1·136	·8
9	·975	·975	·984	·989	1·003	1·025	1·058	1·091	1·138	·9
10	1·000	1·002	1·008	1·018	1·030	1·050	1·075	1·110	1·152	1·0
△	1·000	1·001	1·006	1·018	1·036	1·060	1·091	1·128	1·173	·5

Explanation of Tables and Diagrams I. and II.

To find the loss due to guide friction, multiply the values in Tables I. *a* or I. *b* by $\phi \times$ IHP.

To find the loss due to crank-pin friction, multiply the values in Tables II. *a* or II. *b* by $\phi \frac{d}{s} \times$ IHP. × 1·57.

ϕ = Co-efficient of friction. **d = Diameter of crank-pin or shaft.**

s = Length of stroke. **IHP. = Indicated horse-power.**

The lines marked △ give the values for triangular diagrams.

RATIO OF MAXIMUM INCREASE OF ENERGY TO INDICATED WORK PER STROKE.

TABLE III.—*Single Engine.*

Cut-off Stroke.	Connecting Rod ÷ Stroke.									Cut-off Stroke.
	∞ ÷ 1	6 ÷ 1	3 ÷ 1	2 ÷ 1	3 ÷ 2	6 ÷ 5	1 ÷ 1	6 ÷ 7	3 ÷ 4	
·1	·329	·352	·374	·396	·417	·441	·465	·489	·515	·1
·2	·298	·322	·345	·371	·397	·423	·448	·477	·505	·2
·3	·277	·300	·324	·351	·380	·407	·435	·465	·496	·3
·4	·260	·283	·308	·336	·363	·393	·423	·454	·488	·4
·5	·248	·271	·295	·323	·350	·379	·410	·444	·480	·5
·6	·238	·259	·284	·311	·339	·367	·399	·434	·471	·6
·7	·228	·249	·273	·301	·329	·358	·389	·426	·463	·7
·8	·219	·241	·264	·292	·320	·349	·382	·417	·455	·8
·9	·212	·233	·257	·284	·313	·341	·373	·409	·448	·9
1·0	·205	·227	·250	·277	·306	·334	·367	·403	·440	1·0

TABLE IV.—*Double Engine.*

Cut-off Stroke.	∞ ÷ 1	6 ÷ 1	3 ÷ 1	2 ÷ 1	3 ÷ 2	6 ÷ 5	1 ÷ 1	6 ÷ 7	3 ÷ 4	Cut-off Stroke.
·1	·072	·092	·114	·136	·158	·179	·202	·227	·246	·1
·2	·049	·070	·092	·115	·139	·161	·184	·211	·236	·2
·3	·032	·052	·075	·099	·122	·147	·173	·199	·227	·3
·4	·020	·041	·063	·089	·113	·138	·165	·191	·222	·4
·5	·013	·033	·056	·082	·107	·131	·159	·189	·216	·5
·6	·009	·030	·054	·078	·104	·128	·156	·183	·212	·6
·7	·000	·030	·052	·078	·102	·126	·154	·181	·209	·7
·8	·011	·031	·054	·079	·103	·127	·152	·180	·206	·8
·9	·015	·036	·058	·082	·105	·128	·153	·179	·205	·9
1·0	·022	·043	·064	·086	·107	·131	·154	·179	·204	1·0

TABLE V.—*Treble Engine.*

Cut-off Stroke.	∞ ÷ 1	6 ÷ 1	3 ÷ 1	2 ÷ 1	3 ÷ 2	6 ÷ 5	1 ÷ 1	6 ÷ 7	3 ÷ 4	Cut-off Stroke.
·1	·0227	·0279	·0358	·0437	·0528	·0628	·0722	·0842	·0993	·1
·2	·0083	·0166	·0266	·0349	·0476	·0588	·0711	·0850	·1015	·2
·3	·0052	·0161	·0253	·0367	·0478	·0600	·0720	·0850	·1010	·3
·4	·0083	·0175	·0266	·0371	·0480	·0589	·0698	·0816	·0965	·4
·5	·0085	·0166	·0251	·0349	·0454	·0554	·0663	·0772	·0900	·5
·6	·0076	·0153	·0227	·0315	·0406	·0506	·0610	·0716	·0839	·6
·7	·0063	·0131	·0205	·0279	·0367	·0462	·0556	·0668	·0785	·7
·8	·0059	·0112	·0175	·0249	·0332	·0417	·0512	·0615	·0738	·8
·9	·0065	·0112	·0170	·0236	·0306	·0389	·0480	·0585	·0702	·9
1·0	·0059	·0109	·0163	·0223	·0292	·0373	·0462	·0567	·0680	1·0

Explanation of Tables and Diagrams III., IV., V.

To find the inertia in foot pounds of the revolving masses of an engine necessary to hinder the speed from varying beyond certain limits of the average speed, multiply the value in the tables by $\frac{\text{IHP.} \times 1{,}500{,}000}{\eta\, n^3}$.

To find the weight of a fly-wheel in tons which will produce the same effect, multiply the values in the tables by $\frac{\text{IHP.} \times 21600}{\eta\, n^3\, R^2}$

η=Co-efficient of uniformity=$\frac{\text{maximum speed—minimum speed}}{\text{mean speed}}$.

n=Number of revolutions per minute. R=Radius of Flywheel. IHP.=Indicated horse-power.

MILD STEEL IN FRENCH ARSENALS.

On the Use of Mild Steel for the Construction of the Hulls of Ships in the Arsenals of the French Navy.

By M. Marc Berrier Fontaine, Member.

(*Continued from page* 56.)

SUCH a divergence of opinion, which moreover, I am assured, is to be found also on the other side of the Channel, appears to me to be one of the best proofs possible of the almost perfect equality of the two rival processes. For if the superiority of produce obtained by either of them was undoubted and constant, it could hardly fail to have been long ago recognized by the constructors, who have to work up the steel obtained, and by the manufacturers themselves, who have not, as a general rule, any particular interest in either of the two processes mentioned, seeing that they habitually use them side by side. The daily increasing homogeneity of the plates and moulded bars which are used in our dockyards does not seem to me, nevertheless, the only cause of the increasingly satisfactory results obtained in the various processes to which these materials are submitted in the yards. Our experience tends to prove, in fact, that the increasing familiarity of the workmen employed in these processes, particularly upon those plates and bars which are worked hot, has had at least an equal share in bringing about this fortunate result. Greater practice in using the new material, and increasing familiarity with it, if I may use such an expression, a more thorough knowledge of its qualities and of its defects—of its strong and of its weak points—in a word, of its behaviour and of the special management which it requires, so as not to produce failures, and even the confidence which is gradually showing itself in their treatment of it, are all causes tending strongly to the same end. I have several times, for example, had to remark that it is not generally the workmen having most experience in skill in working iron who manage most quickly to understand the working of steel in the most satisfactory manner. Although this fact may seem paradoxical at first sight, there is nothing in it which ought really to surprise us, for skilful workmen, accustomed for many years to certain processes of work, and to certain tricks of hand which they have always found succeed, and having, moreover, complete confidence in themselves, without reflecting that a metal which does not differ from iron in external appearance can possibly have different properties, will naturally treat it in the same manner.

It is thus only after repeated failures that they become convinced that the new metal has a different behaviour from that of iron. It is still later that they come to admit that this new metal, provided it is treated by them with a certain special management, is, taking it all in all, more manageable than iron, and able to bear without danger abrupt bending which iron will not bear even when of exceptionally good quality. The younger workmen, on the contrary, have less settled habits, and at the same time they have less confidence in their own skill, and thus are more ready to conform with docility to the advice given them and the instructions which they receive; in a word, they have not got to unlearn anything, as is the case with their older and more skilful fellow-workmen. Consequently, when they are clever and intelligent, they are the first to understand how to work steel as it ought to be worked. If, for instance, they have to submit a piece of steel to rather trying treatment which cannot be completely finished before its temperature falls below a dull red, workmen skilled in handling iron will be disposed, even, according to their notion, in their employer's interest, to continue their work at a black heat, because they know that a similar piece of iron would not suffer from this, and before having gone through a fresh apprenticeship they cannot realize, however often they may be told of it, that a similar piece of steel will not behave itself in exactly the same manner. The younger workmen, especially those who have not learned to work in iron before working in steel, are naturally free from these prejudices and from this instinctive resistance to the advice given them, they will not hesitate to stop their work at once as soon as it cools to a dull red, and to return the work to the furnace or the forge to give it the fresh heat that is sufficient in many cases to avoid the defects and injuries which their older and more experienced companions consequently find they have to pay for more often than their younger fellow-workmen. It is hardly necessary to add that the more skilful of the iron workmen, as a rule, very quickly pick up the distance which their younger fellow workmen who had fewer traditions to unlearn were able to gain over them in working the new metal. After some months it is found that the balance is restored and that the old skilled workmen have again taken the first place, which they had only momentarily lost. The best workmen for iron are then found to be also the best for steel, and in fact they soon take so kindly to the new metal that they would look with contempt upon a proposal to return to working in iron, a remark which has been very justly made by Mr. W. Denny in his very interesting communication "On Steel in the Shipbuilding Yard," read by him last year before this Institution.*

It seemed to me that it might be interesting to go into some detail respecting this cause of the steady and progressive improvement of the results obtained in working steel, because it has not until now, so far as I am aware, been pointed out by anybody, although it has several times been brought under our notice in the most striking manner, especially during the first months in which the use of steel was largely developed in our dockyards. I will quote what I consider a very conclusive example of the influence of this cause. The frame of the *Foudroyant* behind the armour-plating is formed of H or double tee-bars of 300×148×14 mm. (Fig. 1, Diagram 1.), which being cleft at their two ends had to be bent into the shape represented on Diagram II., Figs. 1, 2, and 3, the curve of the upper half having to be joined to a similar curve in the corresponding deck-beam formed by a double tee-bar of the same scantling. This has always been attained without any difficulty, which might very well be, seeing that by the continuous character of the curvature in question the strain to which this end of the piece of work was exposed was evidently less severe than the forge test required before the same bars could be received, a test in which half of the bar has to be, not bent out upon a continuous curvature, but sharply bent, and almost folded at its stem, being kept straight for the rest of its length. The lower half of the bar was in quite a different case, having to bear a much severer trial than that of the receiving test,† one-half of the bar having to be bent at a right angle with a joining curve of a very small radius. Again, among the first bars which had to be submitted to this trial there was a considerable proportion which could not bear it, the extension of the curved part taking place all at once on the very short length of one side or the other of the point of greatest curvature, marked A upon the figures, the thickness of the web being thus suddenly reduced at this point A, and it frequently cracked. A considerable number of bars had to be returned for this cause.

When, however, we heard that the frames of the *Devastation*, a ship built from the same drawings as the *L'Orient*, had perfectly well borne this same work, we were naturally induced to suppose that our failure at Toulon was due to an inferior quality in the double tee-bars which had been delivered to us. Further experience, however, very soon convinced us that it was not so. The proportion of damaged pieces began steadily to diminish, and we soon came to have to reject none. It was not possible to attribute this improvement in the results to any corresponding improvement in the quality or homogeneity of the metal, since the whole of the bars necessary for the frames of the *Foudroyant* had been turned out from the same works and delivered together. It could have in reality no other cause than the improvement in the processes of work necessary to mould the different pieces mentioned, an improvement entirely due to the greater practice the workmen had obtained in getting them into shape. It seemed to be all the more necessary to insist on the extent of the influence which increasing practice and skill on the part of the workmen could have upon the results obtained, in that the ship constructors, who have only recently begun to make use of steel, and who have not yet got out of the period of failure due to the fact that the apprenticeship of their workmen is not yet finished, will find in this a reason for not being discouraged; when they know that their predecessors have had to go through the same trials and pass through the same ordeal of mistakes, but nevertheless succeeded pretty quickly in shaking off these small troubles as soon as their workmen had obtained sufficient experience of them, they will be more disposed to persevere. I think, therefore, that I am rendering a real service in persuading them to continue the use of a metal, the superiority of which they will not fail soon to appreciate, although they may still entertain some doubts about its qualities.

There is a third cause whose influence in the improvement of the results obtained in working steel acts favourably for us. I mean the successive improvements which have been already introduced, and are being daily introduced, in the stock of tools in our shops. The new metal requires to be treated with much more care and management than iron. It will not bear, without suffering from it more or less, violent blows from iron hammers, or the irregular tears produced by using hand chisels. All the improvements in tools which can save us from having recourse to such blows and faults, and all those whose effect is to hurry the work on the plate while hot and to secure its being finished before the temperature of the stuff has fallen below the dangerous limit of dark red heat; all these improvements in our tools, I say, cannot fail to contribute most effectively to the perfection of finish of the work. As examples of the most important improvements in tools that I mean, I may point out the following: For the hot bending of plates, the replacing of furnace heat, which was formerly used, by gas ovens in which the plates and moulded bars can be raised to higher and more uniform temperature, has had for one of its results great economy of time and money, since the use of these new furnaces has enabled us to reduce in many cases the number of heats, and has given us much greater facility in carrying through the work itself; because the metal, being thus more strongly and uniformly heated, becomes much more malleable and ductile, and yields much more easily to all the changes of form to which it is subjected.

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* Transactions Institution of Naval Architects, vol xxi., 1880, page 188.

† See the conditions of this test, Appendix A.

The already long experience of the works of Lorient, where ovens on the Siemens system were in use from the beginning, has been fully confirmed on this point by the experience of the works at Toulon, where ovens on the Gorman system have been preferred on account of their great simplicity of construction and management. These last ovens have been already at work for five years very satisfactorily, this result having been secured in great part by certain important changes in the position of their gas producers which experience has forced upon us.

The use of methods of mechanical traction, securing a high and steady speed without any sudden variations, as been developed as much as possible both for drawing the hot metal from the ovens and taking the work without loss of time to the points at which it is to be worked, and also for getting it into shape in a progressive manner without jar or shock. At Toulon we use for all work of this description two capstans driven by small hydraulic engines on Brotherhood's system, and also return pulleys suitably arranged to control all the movements of the waggons running upon trams inside the workshop. As soon as a piece of metal is brought to a fitting temperature, it is seized in the oven by pincers, to which a cord is made fast, which, passing over other return pulleys, passes to one of the two capstans. A workman starts it by pressing his foot on a lever close to the ground; a few turns, occupying only a few seconds of time, are enough to get the piece thus drawn on the plates alongside of the guides upon which it is to be moulded; one of its ends being quickly fitted against these guides, the other end is clutched by a claw which is hauled upon by a cord seized upon one of the capstans; with a few turns of this capstan, which again only takes up a few seconds of time, the piece of work is brought to the necessary curvature steadily, without any sudden shock or jar, consequently without injury, and at a heat at which it still retains all its malleability. While the capstan thus does the chief part of the work, the hammermen have only got to set right the parts which tend to start or buckle. Treated in this way, it can be so rapidly brought into its final shape that it is still red when the work is finished, and the heat which it still retains is amply sufficient to anneal it without its being necessary to give it a fresh heat for the purpose.

The substitution of wooden swages and mallets for iron swages and hammers, which formerly were in almost exclusive use for working plates and moulded bars, is a great improvement, although one which it has been most difficult to get the workmen to adopt. They assert, not without some reason, that even with equal weights they cannot obtain with wooden mallets, which are not so hard and which suffer compression, such strong and effective blows as those with iron hammers, which act upon a smaller extent of surface; but it is exactly these very strong pressures brought by iron hammers upon a limited portion of surface which tend to produce permanent local injury, these injuries being perfectly visible and due to the metal being crushed and tempered (so to speak) in a little ring, corresponding to each blow of the hammer, without its having, as a consequence, lost any appreciable part of its homogeneity. We therefore insist in our workshops on the use of swages and mallets of wood for working steel in all cases in which the shapes to be obtained are too abrupt in form to render their use impossible. Experience has, moreover, shown us that good workmen quickly get to bend all plates of ordinary curvature, using exclusively wooden swages and mallets, and that they are only obliged to use iron swages or hammers for plates of exceptionally sharp curvature. In these exceptional cases, it is necessary to be very careful to see that the work which has been subjected to such violence is carefully annealed afterwards. The iron pins and rings which are ordinarily used for moulding on the bending floors, the curves to which the bars have to be wrought, have, when steel bars are concerned, the great inconvenience of presenting but a very small bearing surface on account of their small diameters, the result of which is that these pins often give a local nip to the plate pressed against them, which produces a more or less deep impression on the edge of the plate, or at any rate a bend, in consequence of which the curvature of the edge ceases to be regular.

To avoid these inconveniences it became a practice to trace the mould, not directly by the help of pins and rings, but by a strip of plate previously bent to the proper mould and resting against the pins.* The exchange of these pins and rings of small diameter for drums of cast iron of considerable diameter has allowed us to abandon the use of these aligning strips. The very useful introduction of these cast iron drums, bored to receive the pin which fixes each of them to the bending floor, with a series of holes spirally arranged at progressively increasing distances from the outer circumference, was, I believe, introduced by Mr. Denny. It was at any rate at their works that I first noticed these discs. They have been introduced since into the tool supply of the Toulon Works, where they have given perfect satisfaction. We also regard as a marked improvement the substitution of the progressive and steady pressure of hydraulic presses for the sharp and violent jar of steam hammers for all work taking strong curvatures or sharp changes of form. Thus the very extensive development of water-pressure machines allows us at the present day to obtain with great facility clubbed ends, quoted as examples by M. Barba † as well as a great number of pieces of similar work, punched, clubbed, or moulded to sharp curvatures. Some examples of pieces of work thus obtained are represented on Diagram II., Figs. 4 to 8. So again, water pressure has been used with complete success in forming garboard strakes and other plates. In all such cases the action of hydraulic presses, while quite sufficiently rapid, is so steady that it is seldom necessary to anneal the work subjected to it. The use of steady and progressive pressure is, moreover, at least as useful in the work done cold as in that which is done hot. So again the use of hydraulic presses gives the most satisfactory results when applied to the work of fitting and moulding angles or other work with sufficiently open curvature to admit of their being done cold. This is the case with all the deck beams as well as for the greater part of the angles of the longitudinal stringers, and also for a very large proportion of the angles of the frames. At Toulon this work is performed by presses of graduated power from 5 to 100 tons, some vertical, some horizontal, to suit all possible cases. One press of 100 tons is quite sufficient for the straining and moulding of double T-bars of iron of 350 mm. × 150 mm. × 15 mm., and of steel bars of 300 mm. × 148 mm. × 14 mm., Fig. 1, Diagram I. The profiles of these are among the most rigid forms of all those with which we have yet had to deal. A press of 50 tons is sufficient for the straightening and moulding of almost all the other forms that we use, from that of H or double T-bars of steel of 250 mm. × 10 mm, 130 mm, Fig. 2, diagram I. Finally, the small 10-ton presses can easily mould steel angles of 150 mm. × 150 mm. × 15mm., and 5-ton presses will mould steel angles of 120 mm. × 120 mm. × 12 mm. I do not think at this time of day it is necessary for me to discuss at length the advantage that we find in the use of hydraulic machines of other types which we possess in our assortment of tools at our plate-working shop, which is completely fitted with machines on this system, because the advantages which it offers are not special to working plates and moulding bars of steel, but are equally useful for the same work in iron.

These advantages, moreover, have been fully explained and discussed by me in a separate paper read by me three years ago at a meeting of the Institution of Mechanical Engineers in Paris.‡ I cannot, however, pass over without remark the smoothness of work of the hydraulic machines for punching and shearing, the complete absence of jar or jerk in the speed of the tool at the moment that the tool comes into contact with the work to be punched or sheared. These are very advantageous conditions for working on steel which has to be treated with all possible care. Although it has not yet been possible for me to undertake precise comparative trials on this subject, it seems to me to be very nearly certain that the action of punches or shears worked by hydraulic pressure must upset very much less the edges of the holes or cuts made in the steel plates with consequently less damage to their uniformity than would arise from the use of a punch or shears driven by mechanical transmitters of motion, in which the tool always reaches the work with a considerable speed, the work being consequently exposed to more or less jar or jerk.

If, as seems to have been established by the comparative trials,

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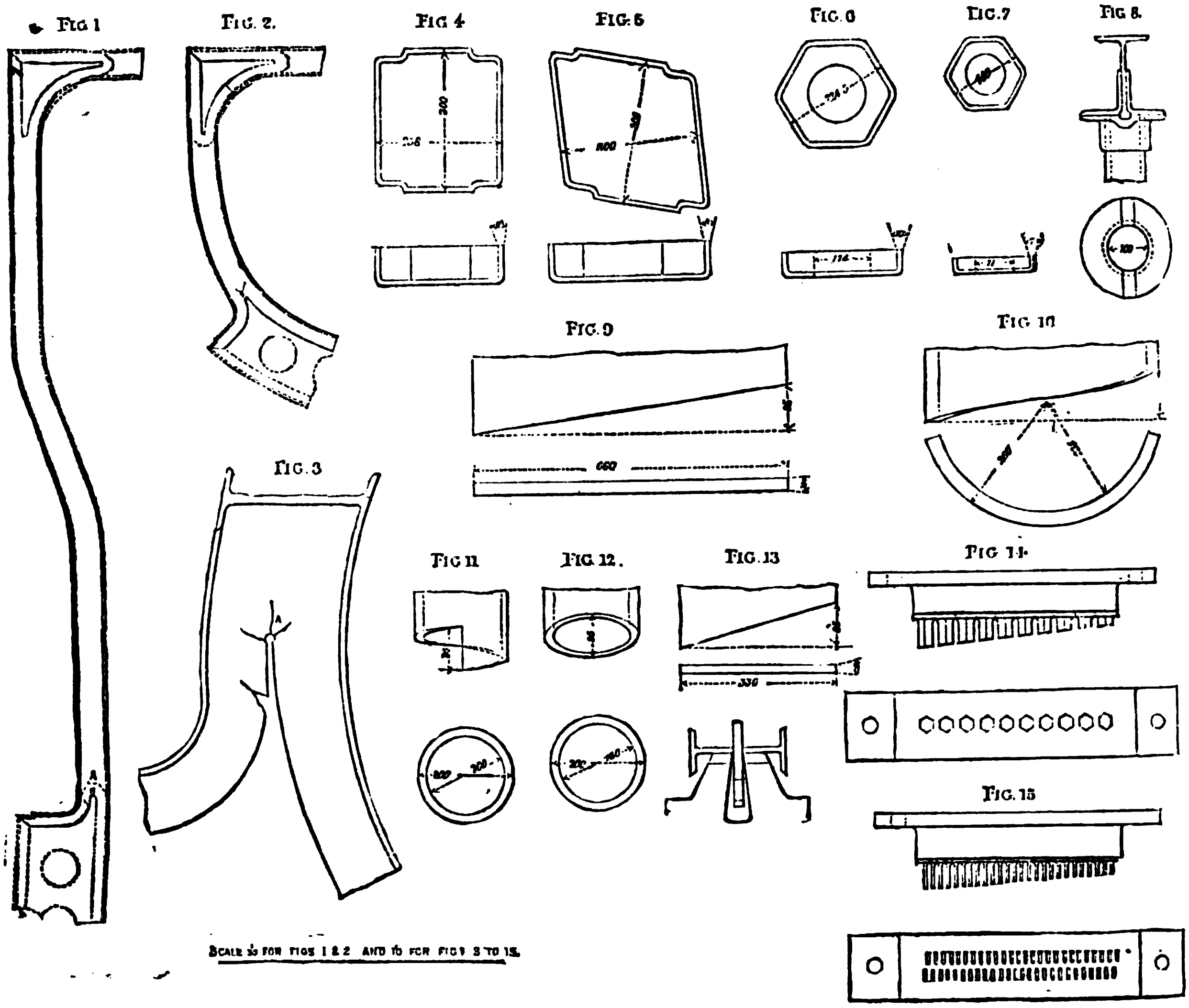
* "Treatise on the Use of Steel in Shipbuilding," by Mr. I. Barba, second edition, p. 78.

† *Ibid*, second edition, pp. 63 and 64.

‡ Proceedings of the Institution of Mechanical Engineers, June 1878: No. 3, Paris meeting, p. 346.



MILD STEEL IN FRENCH ARSENALS—Diagram II.

of which the results were communicated in 1878 to this Institution and to the Iron and Steel Institute, the mere substitution of a punch with a helix for its cutting edge, which is thus brought to bear progressively on the consecutive portions of the circumference of the hole to be made (Kennedy's patent spiral punch), for the ordinary punch of which the cutting edge is in a horizontal plane, and is brought to bear all at once on the whole of the circumference; if, I say, this simple change is sufficient to insure that the metal shall be less upset on the edge of the hole, we must also admit without hesitation that the greater smoothness of action of hydraulic punches and shears, must have just as favourable an effect, and that the introduction of these machines must consequently tend to render less necessary the annealing process to which it is still considered desirable to subject plates and moulded bars in steel after they have been punched or sheared. Again, with the object of avoiding for steel all useless "punishment," we take great care to rid ourselves of all processes which crack or upset more or less deeply the edges of the plates or the ends of moulded bars, and which leave more or less irregular burrs. As Mr. Barnaby has very justly said, in a communication "On the Use of Steel in Naval Construction," read in 1879 before the Iron and Steel Institute," When the end of a bar of iron is cut off roughly, and is left ragged, the layers break off suddenly if struck heavily, whereas the other end of the same bar trimmed off evenly will bear heavy swaging without rupture. The one end behaves far better than common iron would, the other far worse."

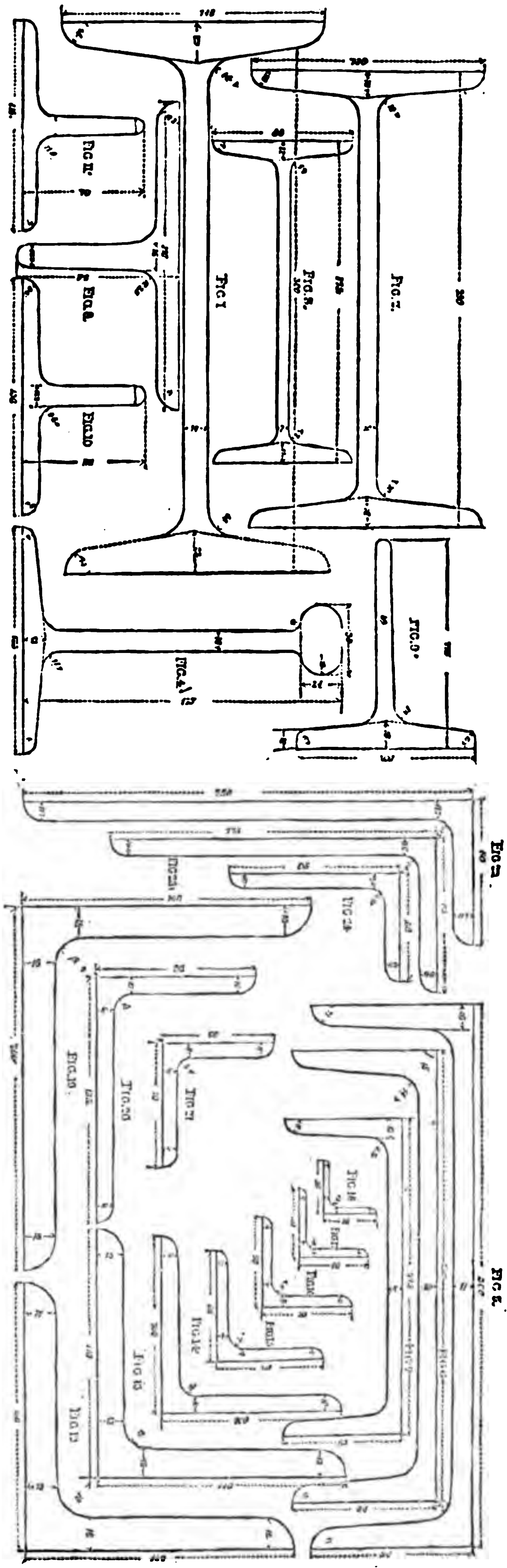
These considerations have led us to forbid absolutely the use of the punch for making cuts in the plates, whether straight or curved by a string of holes. In that respect again the exceptionally large stretch of our hydraulic shears, which is uniformly of 1·50 metre, or 5 feet, gives us a great advantage, for it allows us to shear the largest plates in any direction whatever, and to cut sheets of any length whatever up to 3 metres wide straight across. As regards curved cuts, we obtain them at once by means of a series of blades having graduated curvature, and brought sufficiently close to one another for them to cut out with sufficient exactness all shapes which can occur, whatever be their curvature. A collection of bent blades of this kind makes an outfit which is extremely valuable and quite new as I think. I can give you no better idea of the shape of these blades than by saying that we can suppose them to be obtained by rolling the flat blades of a shearing machine on cylinders of selected radius, without altering the length of the blades or the inclination of their cutting edges; for curves of large radius the blades thus moulded can only give greater or less proportions of the circumference of a circle, and several cuts are necessary to make a complete circle. If, on the other hand, the curvatures that one wishes to obtain are sufficiently marked for the corresponding perimeters to be less than the length of the rectilinear blades, the bent blades really form large punches, which can cut holes of very great diameters at one stroke. I may mention, by way of example, that some of our shearing machines had been designed for cutting in a straight line at each cut a length of 65 centimetres. For circular curves of less than 10 centimetres radius, these blades become closed cylinders, which permit us to punch with one stroke circular openings of 20 centimetres diameter. I would remark that if these closed blades had been actually obtained from rectilinear blades belonging to the same machines, by rolling the latter upon cylinders of suitable diameters, they would give, as in fact Kennedy's spiral punch does give, a sharp step, with its riser following the generating line of the cylindrical surface, upon which the two extremes of the rolled-up blade would lie (Fig. 11, Diagram II.). In order to avoid this inconvenience which would weaken the blades and make it more difficult to support them, while still retaining the screw-shape for the cutting edge of all these open blades (Fig. 10), we give up this form for the closed cutters, and substitute for it in this case the elliptical form (Fig. 12), obtained by intersecting the cylindrical surface for the cutter by an inclined plane.

I would finally point out, before leaving this subject, that the extension of the same principles has enabled us to adapt to our shearing and chiselling machines blades with two cutting edges (Fig. 13), used principally for splitting without distortion the ends of bars which have to be more or less open to the end; the slope of these blades with two cutters is made equal to twice that of simple shears of the same machines. Or we may adapt to them a set of multiple punches, coming into play successively, which allows us to make both rapidly and economically the holes in deck plates (Fig. 14), and ventilating holes as well as bulkheads (Fig. 15, Diagram II.). The use of circular saws and of endless saws which can cut steel cold, are equally useful to us for cutting off moulded steel bars, and strictly speaking trough iron cannot be cut with shears. In order to cut off or finish the ends of the great part of these bars it was formerly necessary to use either planing machines, the work of which was extremely slow and expensive, or to employ workmen with chisels and hand-hammers, of which the violent and repeated blows considerably upset the ends of the bars. By means o sawing cold we can, on the contrary,

MILD STEEL IN FRENCH ARSENALS—Diagram I.

SPECIMENS OF VARIOUS SECTIONS OF BARS EMPLOYED IN THE FRENCH NAVY

SCALE ½ NATURAL SIZE



N.B. The Weights marked on the Sections are in kilogrammes per metre run.

cut right across or in oblique directions bars of all sections perfectly clean and sharp without in any way upsetting the ends of the bars, and without its being found necessary to anneal them after the work is finished. I think we may say generally that the tools which carry out the most exactly the work which we have to do, whatever it may be, are at the same time those which least upset the neighbouring portions of the pieces of work upon which they act. It is with a view of carrying this principle into practice that we do not hesitate, whenever it does not appear to us absolutely impossible to do so, to replace hand-tools, the work of which is always irregular and more or less coarse, by machine work, which, on the contrary, is always steady, regular and uniform. We attach, moreover, particular importance in all our tools, of whatever nature they may be, to using nothing but steel of the best mark and of most carefully selected quality, however much higher the price may be. We at the same time take care that the working angles of these different tools should be set as may be most suitable for each kind of work.

Finally, we require that the most rigorous and the most unceasing attention should be given by the foremen and by the workmen themselves to seeing that the cutting edges of their tools should always be kept in the most perfect condition. In order to secure as far as can be this last requirement, we have been induced to develop very largely the employment of grinding machines, with artificial emery grindstones specially arranged for setting the tools of various forms, these machines allowing us to obtain a regularity and a precision of edge which it would be impossible to obtain by hand. These artificial emery grindstones are also very useful for the work of taking off burrs, and finishing both plate work or moulded bars, as well as in finishing the small forge pieces, such as ringbolts, staples, hinges, and so forth, which form so large a part of modern construction. Formerly these things could only be executed with the file and chisel, which gives much less satisfactory and more costly work. It will be impossible for me, without exceeding the limits of time imposed upon me, to go into the complete detail of the saving which we have been able to obtain through the improvements in the tools, among which I thought it right to point out, as above, a certain number of the most important. I will therefore confine myself, in order to give an idea of the importance of the saving which we have thus been able to realize, to quoting a single example. The comparative trials, made with the greatest care and prolonged through several months, have put us in a position to assure ourselves with perfect certainty that the simple replacement of the flat-ended dies which, until then, had been exclusively used for our punching work by twist drills of the best quality set with mathematical precision by the help of a small special machine with an emery wheel, has permitted us to effect, in the execution of work of this nature, a saving of very nearly one quarter (exactly 22 per cent.)

I have endeavoured to show in what goes before that three principal causes have mainly contributed, and still contribute every day, to the constant and progressive improvement of the results obtained in working plates and moulded bars in steel, of which the framework of our ships now almost exclusively consists. This improvement has, moreover, led the constructors of the French Navy to the same conclusion as their colleagues in the British Admiralty; the possibility, and even the desirability, of relaxing by slow degrees, but steadily, and continually more and more, the severe requirements which had at first been imposed by them for the execution of work of every description to which the plates and moulded bars of steel should be submitted in the dockyards. We have already been able to introduce numerous and very important relaxations in the extremely rigorous and expensive precautions which had been recommended by the French constructors in 1874, and specified as absolutely necessary by the English constructors up to as recent a date as the year 1879.[*] It thus happens that the cases in which it is judged necessary to anneal steel plates and moulded bars are now incomparably less frequent than they used to be a few years ago, and the number is still undergoing daily reduction. Thus also it happens that we are returning by degrees to the use of the simple punch, without annealing and without riming, for cutting holes in almost all the pieces of framework of the new constructions, reserving the use of the drill for those pieces only in which there is special reason for keeping up the greatest possible strength, having regard to the more important position that they have to take in the construction, or the exceptional strains they may have to bear. It is worth while, moreover, to remark that the very rigorous precautions to which the constructors were obliged to confine themselves as a matter of principle, when they began to make use of plates and moulded bars of steel, were principally—I might almost say wholly—intended to meet the local want of homogeneity resulting from the strains more or less violent which the work had to undergo in the workshops, and that the precautions in question were directed beyond everything to prevent those singular breakages which then used to be common enough, and which gave besides all the more anxiety because their true causes had not yet been completely ascertained. If the constructors had not been influenced by the fear of seeing at every instant, and without apparent reason, such accidents produced, the exceptional precautions would have been set aside much sooner, and they would, consequently, long ago have submitted to the small loss of strength produced by the various manipulations through which these steel plates and moulded bars have to pass; just as, for instance, they have always accepted, without any difficulty, the corresponding loss of strength which plates and moulded bars of iron have to undergo. The most recent trials appear to prove that the loss of strength in question is not much greater in these cases for steel than for iron. It seems no me, therefore, to be beyond doubt that at no distant period—as soon as the breakage of steelwork becomes sufficiently rare not to require greater precautions in working these pieces than those which are applied to iron, that is to say—we shall very soon get into the way of punching nearly all the steel plates and moulded bars, and of only annealing them in exceptional cases, when they may have been submitted to very violent and very trying deformations; a treatment, in fact, precisely similar to what we give to iron under the same circumstances. Notwithstanding the very considerable relaxations which have been introduced into the precautions which had been thought necessary at first, the proportion of fractures which occur in working steel plates and bars (fractures of which a minutely exact account has been kept) has been steadily diminishing, and is now reduced to a very low proportion.

I have collected with a few unimportant omissions, the results obtained in this respect in the works of the five principal French dockyards and in those of the Société des Forges et Chantiers de la Méditerranée, at La Seyne, near Toulon, from the time at which steel was first introduced on a large scale up to the end of last year. The figures show that the proportion of fractures which occur in working steel has now become extremely small. As has been well remarked by Mr. W Denny,[*] if we were to take as careful account of the corresponding accidents which occur in working plates and bars of iron, we should probably be very much surprised to have to admit that the frequency of accidents of this nature is, in proportion to the total weight of the material used, at least as great, and perchance even greater, for iron than for steel.

I will only mention briefly a fact which proves to what extent the results obtained in working steel are still capable of improvement accordingly as the quality of this metal bcomes more and more satisfactory, and as the workmen who have to deal with it get accustomed to treat it by the processes which suit it best. It cannot be denied that only a few years ago the constructors considered weldings of plates and bars of steel as difficult to execute in a thoroughly satisfactory manner. At L'Orient it was the practice to effect these weldings by putting an iron liner,[†] between the two surfaces of steel which were to be welded together. When it was necessary to use angle irons with sharp angles more or less departing from a right angle, the practice of the same workshop was not to cut the portion which had to be kept flat, so as to avoid the necessity of having afterwards to weld it. They confined themselves, therefore, to arranging the work so as completely to flatten down this part. This was a very long and expensive process. In other workshops the foremen smiths, in order to effect the welding of steel, had recourse to the use of mixtures of very curious character, and containing the most extraordinary materials. Thanks to the more complete homogeneity and ductility of the steels which are now delivered by the manufacturers, thanks also to the increased practice which our workmen have acquired with the new metal, the welding of steel plates and bars can now be effected as easily, as simply, and as satisfactorily as that of similar work in iron, without its being necessary to have recourse to any special process or to the use of any particular flux. A great number of weldings of steel plates and angles have been broken as tests, and the results of these tests, in which the fracture often takes place outside the weld, have finally led us to consider the welding of thin plates of steel as being as certain and perfect as that of similar pieces of iron. Our experience, therefore, fully confirms that of the English and Scotch builders, whose results have been stated by Mr. Martell and Mr. Kirk at one of the recent meetings of the Institution.[*]

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[*] "On the Use of Steel in Naval Construction," by Mr. N. Barnaby: Journal of the Iron Steel Institute, 1879, No. I., pp. 47, 48.

[*] "On Steel in the Shipbuilding Yard," Transactions, Institution of Naval Architects, vol xxi., 1880, p. 187.

[†] "Treatise on the Use of Steel, in Shipbuilding," by Mr. J. Barba, Second Edition, p. 88.

The communication of Mr. H. H. West, "On Steel for Shipbuilding,"[†] led last year to a very interesting discussion relating to the determinateness of the conditions of resistance and elongation which it would be best to require for the acceptance of steel plates and bars intended for use in the hulls of ships, with a view of deriving all possible advantage from the substitution of this new metal for iron, which had been previously almost exclusively used for work of this kind. Mr. West, and with him the greater part of those who took a share in the discussion, expressed the opinion that it would be necessary with this object to considerably raise the inferior limits required for tensile strain by the Admiralty, by Lloyd's Registry, and even by the Liverpool Underwriters' Registry. Mr. West's opinion is that we ought to fix at 30 tons to the square inch, or at 47.25 kilogrammes per square mm., the inferior limit of tensile strain for accepting iron plates or bars intended for use in shipbuilding, and that we ought at the same time to abandon any superior limit for this tensile strain.

It is worth while to remark, in the first place, that the conditions of tensile strength and elongation which have been adopted in England apply alike to all steel to be used in shipbuilding, whether in the form of rolled plates or bars of any thickness or profile whatever; while the French Navy has, on the contrary, fixed upon requirements of tensile strength and elongation which vary according to the thickness of the plates and bars, or the sectional profile of the bars. The different limits thus specified in the French Navy depend upon experimental results, and should not be regarded as absolutely unchangeable. Already, in fact, some of these limits have been altered, and it is certain that others in the turn would be so, if the necessary for it became evident. It must also be admitted that the limits of tensile strength now imposed still present some singular anomalies, among which we may mention the very great relative difference of 4 kilogrammes per square mm. which there is between the limits of tensile strength required for butt straps in steel plates according to whether these are used along or across grain, and the reduction in tensile strength of 2 kilogrammes per square mm. which is allowed between double T bars and simple T bars and bulb iron (Diagram I, Figs. 1—4, page 408 *ante*) as compared with the lower limit required for bars of all other descriptions. Without attempting to explain these few anomalies, which further experience in the use of steel will doubtless cause to disappear before long, I wish to point out that, excluding boiler iron, for which an exceptional amount of ductility is considered indispensable, the inferior limit of tensile strength required by the French Navy is, as a general rule, higher than that specified by the English Admiralty, by Lloyd's Registry, and even by the Underwriters' Registry. It is only, in fact, for the thicker plates of from 20 mm. to 30 mm., and for the stringers and butt-straps of all thicknesses, worked across grain, that the French Navy allows a lower limit of 44 kilogrammes per square mm. or of 28 lb. to the square inch, which is however, more exactly represented by 44.1 kilogrammes per square mm. This is specified for all through by the Underwriters' Registry for all steel used in the hull. As the thickness of the plates diminishes the inferior limit required in the French Navy increases progressively, and for plates of from 6 mm. to 20 mm. in thickness, which includes nearly all those used in modern constructions, this limit already exceeds by 1 kilogramme per square mm. that of the Liverpool Society.

In order to be accepted for use in the French Navy, thin plates from 1 to 4 mm. thick must be subjected to a minimum test of 47 kilogrammes per square mm., which is nearly equal to the inferior limit of 30 tons to the square inch, or, more exactly, 47.25 kilogrammes per square mm., which Mr. West would wish to see adopted; while the minimum tensile strength of the stringers and butt straps tried along the grain, and that of bars of all sections with the exception of double T bars, T bars, and bulb-iron, should be of still higher tensile strength, namely, 48 kilogrammes in place of 47.25 kilogrammes per square mm. If we remember besides that in the French Navy there is no superior limit to the tensile strength of steel presented for acceptance, it will be seen that the total effect of the conditions required by it has had the effect of furnishing it with steel plates and bars having an actual tensile strength very considerably in excess of those of the similar pieces of steel which are used in the same work in the building yards of Great Britain. We must admit at the same time that this superior tensile strength is not bought in the French Navy at the cost of a reduction of ductility in the steel there employed on account of the requirement of a minimum elongation of 20 per cent. at the moment of breaking; that is to say, an elongation equal to that of the requirement of the British Admiralty and of Lloyd's Registry[*] for all plates of which the thickness exceeds 6 mm. for T bars of more than 4 mm., and for angle irons of from 4 mm. to 6 mm. thickness, while the elongation must exceed 22 per cent. for stringers and butt-straps tested along the grain, and for angle-irons and bulb-irons of more than 6 mm. in thickness. It is only, in fact, for double T irons, T irons, bulb-iron, and so forth, of less than 6 mm. in thickness that is to say, for descriptions in which ductility is evidently of less importance, that the French Navy allows of a final elongation at the moment of fracture less than the 20 per cent. which is required by the Admiralty and by Lloyd's Registry. In short, engineers who think with Mr. West that the tests of tensile strength actually required in England for the acceptance of steel intended for shipbuilding are not severe enough, and that the lower limit of these conditions should be considerably raised, may, as will be seen, find a very conclusive argument in favour of their opinion in the practice of the French Navy. It is for this reason that it appeared to me to be of interest to treat this subject in some detail. The real results of the tests for acceptance, show that the true mean resistance of steel plates from 6 mm. to 20 mm. thick, which are those in ordinary use, cannot be estimated at less than 48 kilogrammes per square mm., and that it therefore exceeds the minimum of 30 tons per square inch, or 47.25 kilogrammes per square mm. proposed by Mr. West; but it is necessary to consider that several tests have only established a resistance equal to or even less than 46 kilogrammes per square mm. without these plates having been rejected. It would therefore appear to us to be imprudent to adopt at once a limit lower than 47 to 48 kilogrammes per square mm. for the acceptance of plates which are now admitted as low as 45 kilogrammes per square mm. In fact, notwithstanding that the Navy assigns no superior limit to tensile strength, such a result is implicitly involved, at least to a certain extent, in the condition of minimum elongation to which it is subject, and the effect of adopting a higher figure for the lower limit of tensile strength would in reality have the effect of making the range of tensile strength between maximum and minimum, within which it would be accepted, far too narrow. The result would unquestionably be that manufacturers, finding themselves thus exposed to the chance of more frequent refusals, would not fail to guard themselves against such an increase of the risk that they run by raising their prices accordingly. Economical considerations of the same character, to which we must add others connected with the necessity for keeping down the delay involved in replacing material which has been rejected, and which consequently affects the rapidity of the execution of orders, decided the French Navy in the adoption, now some years old, of the system of acceptance or refusal at the place of manufacture under the superintendence of engineers specially told off for this service, for all plates and moulded bars, and generally for all forms of steel and iron of any importance, for which requisitions are made on the private trade. This proceeding has not been lightly adopted, a long and minute inquiry having been begun in 1869, and carried on during several years, in the course of which all competent authorities have been called upon to express their opinion upon the advantages and inconveniences which they thought might arise from the application of the tests outside the ports of consignment. The advantages of effecting the tests in the workshops, and settling the acceptance there, have been, moreover, thought so evident and so important, that everybody, almost without exception, thus consulted, has given an opinion favourable to their continuance. The inquiry, therefore, came to an end in 1873, and since that date absolutely nothing has occurred to throw a doubt on the wisdom of the decision taken. It is very certain, on the contrary, that the settlement of acceptance or rejection before the despatch of the iron and steel saves the supply of the materials from a very important part of the accidental risks which manufacturers have some reason to dread, and that by facilitating the business between the manufacturers and the Navy, its result is to lower the price considerably; at the same time—and this last advantage is still more important—the service of the dockyards, of which the requirements are frequently urgent, is thus secured more quickly and more satisfactorily, since it is not exposed to suffer the long delay which rejections of material could not fail to involve if they were only settled after delivery of the material at the arsenal.

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[*] "On Steel for Shipbuilding," by Mr. B. Martell: Transactions, Institution of Naval Architects, vol. xix, 1878, p. 3. Also Discussion, Mr. A. C. Kirk, p. 26.

[†] Transactions Institution of Naval Architects, vol. xxi., 1880, p. 208

[*] The length of the test pieces is practically much the same on both sides of the channel, 200 mm. in the test for acceptance in the French Navy, 8 in. or 203.2 mm. for the tests of the British Admiralty and Lloyd's Registry. The tests for elongation are therefore perfectly comparable.

(*To be continued.*)

NOTES ON ANCHORS.

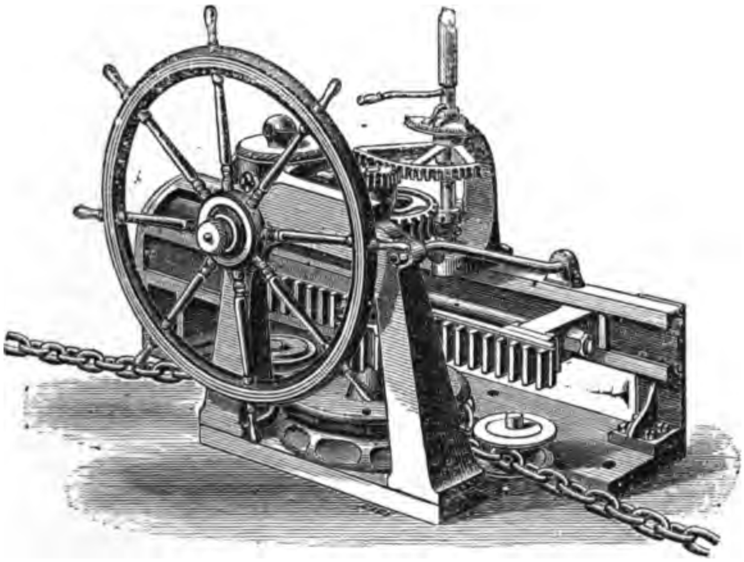
THE possession of thoroughly good ground tackle on board ship, where the valuable lives of so many sailors and passengers are often entirely depending upon its efficiency is of the utmost importance, and yet the construction of the majority of anchors generally in use is such that their *soundness*, owing to the number of welds in each, is a matter of great uncertainty, even when manipulated by the most skilled and careful gangs of anchorsmiths, to say nothing of those made by such workmen whose only aim is to knock out as much work as possible at so much per cwt., not thinking of the serious consequences which may ensue from their endeavours to have a large draw on pay nights. It may be urged that anchorsmiths are deterred from being careless by the knowledge that, if their work does not pass Lloyd's test they are heavily mulcted by deductions from their wages to repair their defective workmanship. This is doubtless true, but is in a manner counterbalanced by the knowledge that a large proportion of their work, especially that for foreign markets, is sent away without being subjected to any proof whatever. It might, however, naturally be supposed that at all events there is safety in the adoption of anchors having a certificate of the Admiralty test from a public proofhouse. No doubt there is *more* safety with such anchors, but still, even in this case, the idea of safety is erroneous, for, although anchors so tested have been subjected to the same *tensile strain* as those used by the Admiralty on board Her Majesty's ships, nevertheless they have not been subjected to the same *proof*, inasmuch as all Admiralty anchors, after being submitted to the regulation tensile strain, are *fire-proofed*, so that any existing defect or flaw (which might not have been observable when the anchor was red hot in the anchorshop before testing), possibly even aggravated by the tensile testing itself, now becomes plainly visible under the valuable safeguard of fire-proofing. It thus follows that all anchors, excepting those for Her Majesty's Navy are subjected to a very *imperfect mode of testing*, and so long as they simply stand the tensile strain and a superficial inspection afterwards, they are put on board ship with whatever internal defects they may have, which do not actually appear on the surface. A further reason why, in the case of anchors, there should be an unusually large margin of strength and certainty of soundness in their construction is that, especially in larger sizes, they are tested to less than one-half the tensile strain of a chain cable of equivalent size, and, moreover, a small portion of each 15 fathoms of chain is cut out and tested to a breaking strain three times as great as that put upon the anchor to which it belongs. The piece of chain subjected to this test is more or less injured thereby, and is consequently thrown on one side, as merely a sample of the average strength of the cable. Such a proceeding could not, of course, be adopted with an anchor without injury by crystallizing the fibres of the iron; nevertheless, the absence of this severe test is the greater reason why anchors should have a larger margin of strength beyond that to which they are actually tested.

SIMEY'S NEW STEAM STEERING MACHINE.

WE are pleased to bring under the notice of our readers an arrangement of steam steering apparatus on the direct acting principle, which has been recently patented by Mr. C. R. Simey, of Sunderland, and of which Messrs. R. Roger & Co., engineers, Stockton-on-Tees, are the sole manufacturers.

The inventor claims for his system and arrangement of steering gear special advantages, which should commend it to the serious attention of shipowners.

It will be seen from our illustration that motion is communicated to the horizontal chain wheel by a rack attached to the piston-rod, and working into a wheel upon the chain barrel shaft in a similar manner to that in which hydraulic cranes are slewed round; and, by a very simple arrangement of valve gear, any one, though uninitiated in steering, can work the machine effectively as regards absence of noise and vibration and also economy of steam. The valve arrangement also is such that the steersman cannot put the helm over too far, while it may, on the other hand, be moved from "hard over" to "hard over" at one stroke of the engine. This feature appears a great advantage over ordinary machines on the "winch" principle, where a considerable number of strokes are required to effect the same result. The slide valve of the engine works on the top of cylinder, which is horizontal, and the steam ports are carried right down to the under side of the cylinder, so that immediately the exhaust ports are opened any water that may be in the cylinder is all carried away by the out-flowing steam in the same manner as in the steam ejector, and so dispensing with the necessity for drain cocks. The machine is so designed that the speed in putting the rudder to "hard over" cannot exceed a certain rate, *whatever the pressure of steam may be*, and the yielding motion of the piston in the cylinder when a sea strikes the rudder is only sufficient to prevent the jar on the machinery. The apparatus is also designed for hand steering, in which case it is worked by means of a worm and worm-wheel, the arrangement generally being such as to prevent the possibility of the steersman being thrown over the wheel, which may be placed as low down to the deck as is found to be convenient. The machine altogether, we understand, requires no more attention, as regards oiling, &c., than an ordinary hand-steering apparatus; the space occupied is also remarkably small, being only 8 ft. athwart ship and 4 ft. 4 in. aft; this, also, for the largest steamers, so that the apparatus can be placed in any ordinary size steering-house, and it is so absolutely silent and free from vibration that it may be placed on the top of a chart-house without annoying the passengers.



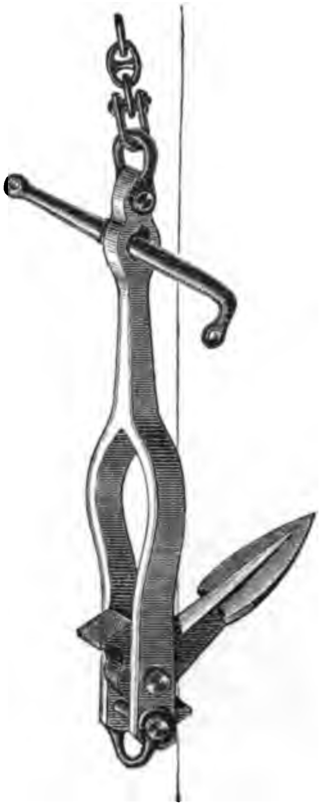
SIMEY'S NEW STEAM STEERING MACHINE.

PATENT ANCHOR.

A NEW kind of anchor, patented by Mr. G. Tyzack, of North Shields (illustrated in this number), has recently, by special resolution passed at a general meeting of the Committee of Lloyd's Register of British and Foreign Shipping, been sanctioned as part of the equipment of vessels intended for classification in the register book of the society. Practical experience of its merits as the working anchor at sea for some years on board several large steamers, besides other severe tests conducted under Lloyd's authority, have decided the Committee to favour this patent with their approval.

The strength of this anchor has been certified by a report under Lloyd's seal, showing that one of them was subjected to various progressive strains, commencing with the ordinary Admiralty test, and increasing until it was broken to destruction with something over three and a half times the Admiralty strain upon it, or 250 per cent. overproof.

This unusual strength is attained by the anchor having only one arm, and the various parts are all increased in strength, to make up the necessary weight required in the classification regulations. The weight of each arm in an ordinary anchor is 25 per cent. of its total, ex stock weight, and this being saved by having only one arm, the parts are proportionately increased in strength. The single arm of this anchor is so arranged that, no matter how it falls or on whatever kind of bottom, it immediately and powerfully holds, in which position it combines the good properties (without the objectionable points) of the Admiralty Rodger, or ordinary anchors, viz.' the strain from the holding part is always in a direct line with the cable, and the vessel can readily swing round at her anchor, the single arm of which acts as a central pivot, and thus has no tendency, as some anchors have, of breaking out of the ground when swinging. There is no projecting arm for a vessel to foul with her cable, and she may in shoal water sit upon this anchor without injuring her bottom. The absence of one arm also makes the anchor less liable to foul vessels' foregrip or to hole her bows when heaving up, and renders it more easy to handle and stow snugly on deck. A further recommendation is that, from its extreme simplicity of construction, being without a weld, it can be soundly made, thoroughly well finished, and put on board at a moderate cost.



An experiment with torpedoes against torpedo nets has just been tried by the Austrian Admiralty at Trieste. A torpedo boat launched a torpedo against a vessel with a torpedo net stationed at a distance of a thousand feet. In twenty-seven seconds the torpedo touched the net and exploded, tearing a hole in the net and sending up a column of water 250 feet in height. The vessel itself was considerably shaken, but not damaged in the least. The charge in the torpedo was half a hundredweight of gun-cotton.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Thomas Coats.—On May 27th the Strand Slipway Company launched a steamer of 1,500 tons, built to the highest class at Lloyd's for Messrs. T. Beynon & Co., owners of the Abercarn Colliery, Newport (Mon.). The vessel was named by Miss Swainston, of Sunderland, the *Thomas Coats*, after Mr. Coats, of Paisley, one of the owners, and was admirably launched by Mr. John Crown, managing partner of the Strand Company. She will be fitted with engines of 120-horse power by the North-Eastern Marine Engineering Company, Sunderland, and is designed for the coal and iron ore trades.

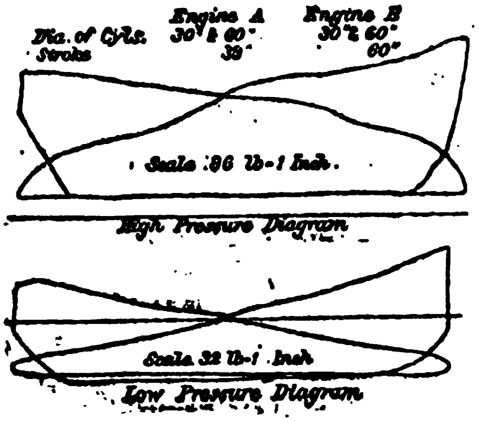
De Bay.—On May 28th, Palmer's Shipbuilding Company (Limited) launched from the Jarrow yard a steamer of 1,700 tons register, called the *De Bay*. This vessel, which is built for Messrs. Capper, Alexander, & Co., of London and Cardiff, is 260 ft. long, 35 ft. 4 in. beam, and 24 ft. 1½ in. depth, and is to be fitted with compound engines working at 80 lbs. pressure, having cylinders 30 in. and 55 in. diameter, with a stroke of 42 in. These will drive a dual propeller on De Bay's patent system. She is fitted with Patent Windlass by Emerson, Walker & Co., London. The vessel is intended for the Eastern and Atlantic trades.

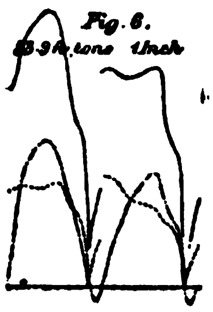
Florence.—On May 28th Messrs. T. Turnbull & Son launched from Whitehall Dockyard, Whitby, a screw steamer of the following dimensions :—Length, 280 ft.; breadth, 38 ft.; depth, 23 ft. 9 in.; with a deadweight capacity of about 3,100 tons, with engines of 180-horse power, by Blair & Co., Stockton-on-Tees, and patent windlass by Emerson, Walker & Co., London. The vessel has been built to the order of Messrs. George Pyman & Co., West Hartlepool, and on leaving the ways was named the *Florence* by Miss Jenny Pyman.

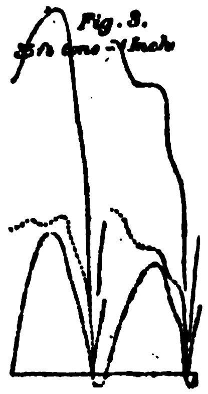
Shelley.—On May 28th Messrs. William Gray & Co. launched from their yard, at West Hartlepool, an iron screw steamer of the following dimensions :—Length, 285 ft. between perpendiculars; breadth, 35 ft. 3 in.; depth, 24 ft. 6 in., class 100 A 1 at Lloyd's. The vessel is built on the three-deck principle to the order of Messrs. Glover Brothers, London, and is intended to carry 2,800 tons deadweight; she is fitted with every recent improvement, including steam-steering gear by Messrs. Halliday, of Sunderland, and patent windlass by Messrs. Emerson & Walker, of London. Her engines are to be fittted by Messrs. Black, Hawthorne & Co., of Gateshead, 180-horse power. On leaving the ways the vessel was named the *Shelley*, by Miss Nichol, of West Hartlepool.

Lemuria.—On May 28th Messrs. Edward Withey & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw-steamer built under the superintendence of Mr. Terrot Glover, jun., to the order of Mr. T. G. Greenwell and partners, of Sunderland. Her principal dimensions are :—Length between perpendiculars, 257 ft. 6 in.; beam, extreme, 34 ft. 6 in.; depth, moulded, 20 ft. 4½ in. She is built to Lloyd's highest class, and has long quarter-deck, bridge-house, and topgallant forecastle, double bottom all fore and aft on the cellular principle, four hatches, and steam winches, and wi'l be topsail schooner rigged. Her decks, chart-house, engine and cabin skylights, and cabin companion are of iron. She will be fitted with engines of 150-horse power, by Messrs. T. Richardson & Sons, of Hartlepool Ironworks. The vessel is No. 98 in the builders' yard, is the third built for the same owner, and the fifth launched by her builders this year. As she left the ways she was christened *Lemuria* by Mrs. J. B. Wilkinson, of Sunderland.

Puerto Riqueno.—On May 28th there was launched from the building yard of Messrs. W. & J. Evans & Co., shipbuilders, Liverpool, a new steamer for Messrs. White, Forman & Co.'s line of Spanish steamers, trading between Liverpool and the island of Porto Rico. Her dimensions are:—280 ft. long, 35·8 extreme breadth, and 24·7 depth of hold, with a gross register of 2,000 tons,







ON STRENGTH OF CRANK SHAFTS.

For description see page 62.

and is built to the highest class on French Lloyd's. She will have engines constructed by Messrs. D. Rollo & Sons, about 250-horse power nominal, on the compound surface-condensing principle, and the vessel and engines were constructed under the superintendence of Mr. G. S. Goodwin. She was christened the *Puerto Riqueno* by Miss Louise Turnbull Forman.

Dorset.—On May 28th Messrs. Joseph L. Thompson & Sons launched from their shipbuilding-yard, North Sands, a screw steamer of the following dimensions, viz.:—Length, 340 ft.; breadth, 39 ft.; depth of hold, 28 ft. 4 in. This vessel has been built to the order of Messrs. Mark Whitwill & Son, of Bristol, for their Great Western line of steamships, trading between Bristol and New York. She is constructed on the longitudinal girder principle, the ballast tanks are divided into eight compartments, six iron bulkheads are fitted, likewise iron longitudinal bulkheads, extending from keelson to upper deck. First-class passenger accommodation will be provided for in the saloon. The 'tween decks of the vessel will be fitted throughout for the transportation of cattle, and the vessel will pass Board of Trade and other surveys necessary for the above requirements. She is of the highest classification at Lloyd's. The engines, which are on the compound surface-condensing principle, are supplied by Mr. George Clark, of the Southwick Engine Works; these are of 300-horse power nominal, indicating 1,500-horse power, having all the modern improvements in marine engineering. She is fitted with Emerson, Walker & Co.'s patent direct steam windlass and other improved machinery. The naming of the vessel, *Dorset*, was performed by Mrs. R. Thompson, of West-house, Fulwell.

Elizabeth Allen.—On May 28 a screw steamer, built for Mr. John Allen, of London, was launched from the iron shipbuilding-yard of Messrs. Bartram, Haswell & Co., South Dock, Sunderland. The principal dimensions of the vessel are:—Length between perpendiculars, 257 ft.; breadth, 35 ft.; depth of hold, 18 ft. 6 in.; deadweight capacity, 2,100 tons. She will obtain the highest class in Lloyd's registry, viz., 100 A1, and M.C. certificate for machinery. The general arrangements of the vessel are—topgallant forecastle, long bridge house, covering engine and boiler spaces, and also the space occupied for the engineers' and officers' cabins, and long raised quarter deck. The cabin in poop aft is fitted up for the accommodation of captain and a few first-class passengers. She is fitted with steam steering gear, by Bow, M'Lachlan & Co.; large size donkey boiler, and four powerful steam winches by Clarke, Chapman & Gurney, and Napier Brothers' patent windlass. The ceremony of christening was performed by Mrs. T. Campbell, wife of the manager of the yard, who named the vessel *Elizabeth Allen*. She will be under the command of Captain Maddix.

Armathwaite.—On May 28th the screw steamer *Armathwaite*, the largest steamer ever built in the Whitehaven Shipbuilding Company's yard, was launched. She is fitted with Emerson, Walker & Co.'s patent brass cone brake windlass, and is a steamer of over 2,200 tons, and belongs to a limited company, Mr. W Burnyeat, jun., being the managing owner.

Peking.—On May 28th Messrs. Wigham Richardson & Co. launched on the Tyne another of the China steamers for Messrs. Siemssen's Line, to the order of Messrs. William Milburn & Co., of Newcastle. The vessel as she left the ways was christened the *Peking* by Mrs. Spence Watson, a sister of one of the builders. The *Peking* is to be fitted with engines of the builders' own make of 200-horse power, from the same design as the engines they made for the Compagnie Transatlantique, calculated for an average speed on service of 10½ knots, and she is now under the 100-ton shears of the Neptune Works, where they are being fitted on board.

Ellangowan.—On June 2nd, the *Ellangowan*, presented to the London Missionary Society by Miss Baxter, of Dundee, was launched from the shipbuilding-yard of Messrs. R. & H. Green, Blackwall, London. She is a composite schooner of 50 tons, yacht measurement, and intended for service at the North of Australia and New Guinea. The dimensions of the vessel are as follows:—Length over all, 60 ft.; beam, 14 ft.; and depth, 7 ft. 10 in. The wood is almost entirely of teak, and in other respects to Lloyd's highest class. The vessel is divided into three compartments, the foremost one for crew, consisting of seven men and the mate; the middle compartment is fitted with broad benches, providing sleeping accommodation for passengers who travel between the different stations doing missionary work, the after compartment being fitted as a saloon, and provided with cabins for the captain on one side, and missionary and wife on the other, each having sleeping berths and all other suitable fittings for the service. This little vessel is to be fitted complete in every respect to enable her to make the voyage out to North Australia. The christening ceremony was performed by Miss Baxter, daughter of the Right Hon. W. E. Baxter, M.P.

Sproston Wood.—On June 2nd, Messrs. R. & H. Green launched at Blackwall a paddle steamer, built to the order of Hugh Sproston, Esq., of the Sproston Dock and Foundry Company, Demerara. Lady Longdon, the wife of His Excellency the Governor of Ceylon, performed the ceremony of christening the vessel, naming her the *Sproston Wood*. The dimensions of the vessel are:—Length over all, 120 ft.; beam (extreme), 29 ft.; depth (moulded), 7 ft. 8 in.; and her load draught with passengers on her station will be about 4 ft.; she has a neat little deck saloon, with a ladies' cabin in the after part. Her machinery will be supplied by Messrs. John Penn & Son, of Greenwich.

Fenella. — On June 9th, there was launched from the building-yard of the Barrow Shipbuilding Company, a twin screw steamer, built to the order of the Isle of Man Steam Packet Company, and intended for their traffic between Glasgow, Liverpool, and Douglas. The ceremony of naming the vessel *Fenella* was performed by Miss Barnett. The *Fenella* is a vessel of about 550 tons, gross register, and her dimensions and particulars are as follows:—Length of keel and forerake, 200 ft.; breadth, 26 ft.; depth, 13 ft. 8 in. Engines, compound d.a., with cylinders 23 in. and 42 in., and two-foot stroke (two pairs), which are expected to give a speed from 13 to 14 knots. The vessel has a long poop, and arrangements are made for a large number of passengers, either for day or night.

Meanatchy.—On June 13th, there was launched from the shipbuilding-yard of Messrs. C. Mitchell & Co., Low Walker, an iron screw-steamer, intended for the Eastern trade. The vessel, which has been built to the order of Messrs. Katz Brothers, of Penang and Singapore, was named the *Meanatchy* by Mrs. Saunders, wife of the future captain of the ship. The steamer is 300 ft. long, 36 ft. beam, and 26 ft. deep, and will be fitted up in the most complete and perfect manner. Her engines, which are 300-horse power, have been manufactured by the Wallsend Slipway and Engineering Company, Limited.

Chateau Leoville.—On June 14th one of the largest steamers built in the port of Sunderland was launched from the yard of the Sunderland Shipbuilding Company. As the steamer left the ways she was christened by Miss Horsley the *Chateau Leoville.* The vessel has been built for a French company. The dimensions are:—Length, 382 ft.; beam, 41 ft.; depth of hold, 31 ft.; gross tonnage, 3,800. She will be engined by the North-Eastern Marine Engineering Company, Sunderland, with engines of 450-horse power. The vessel has three decks, is fitted up for first and second class passengers, and will carry between Bordeaux and New York. She has accommodation for 50 first-class passengers and a number of second-class; will have steering gear of the latest type, and Emerson, Walker & Co.'s patent horizontal direct steam windlass, and be fitted as a three-masted schooner with everything of the best description for all the exigencies of the Atlantic trade. She will also be lighted by Swan's electric light.

Miranda.—On June 14th Messrs. M. Pearse & Co. launched from their iron shipbuilding-yard, at Stockton, an iron screw steamer of the following dimensions:—Length between perpendiculars, 260 ft.; breadth moulded, 33 ft. 6 in.; depth, 23 ft. This vessel, built to the order of Mr. F. Herskind, of West Hartlepool, is about 1,610 tons gross register, and will carry about 2,450 tons deadweight. She is built off the three-decked rule, having two laid, and will obtain the highest class at Lloyd's. She has a short full poop aft, bridge-house amidships, and topgallant forecastle. She will be rigged as a two-masted schooner, having double topsails on her foremast. She will be provided with engines on the direct acting surface-condensing principle, of 150-horse power nominal, from the establishment of Messrs. Blair & Co., of Stockton, is fitted with Emerson & Walker's patent capstan windlass, and has double bottom for water ballast, and all the most recent and improved appliances for expeditiously loading and discharging cargoes. As she left the ways she received the name of *Miranda*, from Miss Herskind, of Seaton Carew.

Largo Bay.—On June 14th there was launched from the shipbuilding-yard of Messrs. Andrew Leslie & Co., of Hebburn-on-Tyne, a steamer, built to the order of Messrs. Affleck & Gray, of North Shields, and intended for the Indian, American, and Black Sea trades. The dimensions of the vessel are as follows:—Length, 260 ft. between perpendiculars; breadth, 34½ ft.; depth, 23½ ft. The vessel has a full poop, long bridge, and topgallant forecastle; has been built under special survey, and is classed 100 A1 at Lloyd's. She has a carrying capacity of 2,500 tons. As the vessel left the ways she was named the *Largo Bay* by Miss Kate Andrews, the daughter of Mr. Joseph Andrews, North Shields. The steamer will proceed to Sunderland to receive her engines, which are of 180-horse power nominal, and built by the North-Eastern Engineering Company.

Cubano.—On June 14th there was launched from the shipbuilding-yard of Messrs. Robert Thompson & Sons, Southwick, an iron screw steamer, built to the order of Senor M. M. de Arrotegui, of Bilbao, of the following dimensions, viz.:—Length, 332 ft.; breadth, 32 ft.; depth, 25½ ft. She has been constructed under Lloyd's special survey to class 100 A 1. Her engines, which are of 300-horse power, are by Mr. Geo. Clark, Southwick. The vessel has two iron decks, the upper one being covered with wood, full poop, bridge, and topgallant forecastle; also an iron wheel and chart-house on the bridge. She has been fitted with all the latest improvements, including six bulkheads, all necessary water ballast and large freshwater tanks, with condenser. The cabin is fitted up aft with captain's and spare berths, the bridge-house amidships, with galley and accommodation for officers and engineers, and for seamen and firemen in forecastle. She has four steam winches and large donkey boiler by Messrs. E. Roger & Co., Stockton, patent midships, steering apparatus by Messrs. J. H. Wilson & Co., Liverpool, patent screw gear aft, Harfield's patent windlass, &c. As the vessel left the ways she was christened the *Cubano* by Miss Soberon, of Liverpool.

Muriel.—On June 15th there was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), at Willington Quay, on the Tyne, an iron screw steamer, built to the order of William Buchan Ritchie, Esq., of Dundee, of the following dimensions, viz.:—Length, 300 ft.; breadth, 36 ft.; depth, moulded, 26 ft. This vessel is to be fitted especially for the Atlantic cattle trade, and for general trades, and will have engines of 38 in. and 71 in. by 45 in. stroke, from the North-Eastern Marine Engineering Company (Limited), of Sunderland, and patent direct steam windlass by Emerson, Walker & Co., London. She was named *Muriel* by Miss Ritchie, daughter of the owner, and will be commanded by Captain Alexander Laws.

Toledo.—On June 18th Earle's Company launched from their yard, at Hull, a steel steamship for Messrs. T. Wilson, Sons & Co. As she left the ways Miss Violet Dobree christened her the *Toledo.* She is built of Martin-Siemen's steel, and is 260 ft. long, 34 ft. broad, and 18 ft. deep. Her gross tonnage is estimated at 1,700 tons, and it is calculated that she will carry 2,200 tons deadweight. She will be brigantine rigged, and has a long quarter deck and bridge. She will have all the most modern improvements for discharging and loading cargoes at four hatchways. The *Toledo* is a similar but larger vessel to the *Borodino*, *Gitano*, and *Sirio*, recently built by Earle's for Messrs. Wilson, and she is intended for the Baltic and general trade. The vessel will be propelled by a single crank engine, of 120-horse power, which will work up to 700 nominal.

Glenmavis.—There was launched from the Jarrow-yard of Messrs. Palmer's Shipbuilding and Iron Company (Limited), an iron screw steamer, built to the order of Messrs. Lindsay, Gracie & Co., Newcastle-on-Tyne, and named the *Glenmavis* by Mrs. Lindsay, wife of one of the owners. The *Glenmavis* will carry 3,300 tons on an easy draught, and is fitted with powerful engines and large boilers. This is the fourth boat built by Messrs. Palmers for the above-named firm.

LAUNCHES.—Scotch.

Fieramosca.—On May 28th, the *Fieramosca*, of Castellamare, an iron screw-steamer, 133 ft. long, was launched at Paisley by the Abercorn Shipbuilding Company, who will fit her with powerful engines for a guaranteed speed of 13 knots. She is classed at Lloyd's, and will have a Board of Trade certificate for passengers, being intended to ply in the Bay of Naples with passengers. The owners are Italian, and contracted for her through Messrs. M'Nicoll and Smith, Glasgow, who are superintending her construction.

Ella.—On May 28th, Messrs. Aitken & Mansel launched from their yard at Whiteinch a screw steam vessel of 750 tons register, built to the order of the London and South-Western Railway Company. This vessel, which was named the *Ella*, will be fitted with compound engines of 220-horse power nominal by Messrs. John & James Thompson, Finnieston, and is now the seventh vessel which Messrs. Aitken and Mansel have supplied to the London and South-Western Railway Company for their passenger and cargo service from Southampton to the Channel Islands and French ports.

Bessie.—On May 28th, Messrs. Thomas B. Seath & Co. launched from their Shipbuilding-yard, at Rutherglen, an iron steam yacht for Mr. John Clark, of Paisley. The vessel, which is named *Bessie*, is of the following dimensions:—Length, 67 ft.; breadth, 12 ft.; depth, 8 ft. 3 in.; and 42 tons yacht measurement. She is fitted with compound surface-condensing engines of 28 nominal horse-power, has 80 lbs. working pressure of steam, and will attain a speed of 10 knots an hour. The engines are supplied by Messrs. Thomas Reid & Son, Paisley.

White Sea.—On May 28th, the second of two steamers which have just been built for the Dundee, Perth and London Shipping Company, was successfully launched from the shipbuilding-yard of Messrs. Alex. Stephen & Sons, Dundee. The new vessel is a sister ship to the *North Sea*, launched for the same Company about six weeks ago, and in every respect duplicates her arrangements. She is 1117 tons gross, and her dimensions are—length. 230 ft.; breadth, 30½ ft.; and depth in the hold, 17 ft. 2 in. Like the *North Sea*, she has been built by Lloyd's rules to class A1 at Lloyd's, and everything has been done to secure large cargo-carrying capacity, combined with small working cost and a fair rate of speed. She will be fitted with engines of 120-horse power, made by Messrs. Pearce Brothers, Lilybank Foundry, and will have steam-steering gear on an improved system supplied by Mr. W. B. Thompson, and Emerson Walker & Co.'s Patent Combination Windlass. A large number of persons assembled to witness the launch, and as the vessel left the ways, a few minutes before three o'clock, she was christened the *White Sea* by Miss Lizzie Leng. The *White Sea* was immediately towed round to the large steam crane in Victoria Dock, where her engines and boilers will be put on board.

Godolphin.—On May 28th there was launched from the shipbuilding-yard of Messrs. W. Pickersgill & Sons, Southwick, a screw steamer of the following dimensions:—235 by 33 by 16, and built to the highest class in Lloyd's to the order of Messrs. J. P. Ninnes & Sons, for the *Godolphin* Steamship Company, of Cardiff. She is well adapted for the shallow Black Sea ports, and the Bilbao trade, and will be fitted with three steam winches, Emerson & Walker's patent windlass, screw steering apparatus, and all the latest improvements. As the vessel left the ways the ceremony of christening was performed by Mrs. H. W. Williams wife of H. W. Williams. Esq., Assistant General Manager of the London & St. Katharine Docks, London, one of the shareholders of the company.

Locust.—On May 30th Messrs. Blackwood & Gordon launched from their shipbuilding-yard at Port Glasgow an iron steamer named the *Locust*, built to the order of Mr. John Burns for the Belfast trade with Greenock. The following are her dimensions:—190.6 by 25 by 13, and about 560 tons. She will be furnished by her builders with compound engines of 100-horse power. This is the second of three steamers for the same trade and owner by Messrs. Blackwood & Gordon for the cattle trade.

Abana.—On May 30th Messrs. Chas Connel & Co., launched from their shipbuilding yard at Scotstoun an iron screw steamer of 2,500 tons. She is classed 100 A 1 at Lloyd's, and has been built to the order of James M. Wood, Esq., Shipowner, Liverpool, and is fitted up with every facility for the rapid loading and discharging of cargo. As she left the ways she was named the *Abana* by Mrs. Newall, Leith, and was immediately towed to the harbour to get her machinery fitted on board, which is being supplied by Messrs. John & James Thomson, Finnieston Engine Works.

Largo Law.—On May 31st Messrs. Napier, Shanks & Bell launched from their Yoker shipyard an iron sailing ship of about 1,720 tons, built to the order of Mr. David Law, Glasgow, and having Lloyd's highest class, under special survey. The *Largo Law*, as the new vessel is named, is fitted with the most complete and approved appliances for her intended service. The ceremony of naming was performed by Mrs. Law, and in a few weeks the *Largo Law* will proceed to San Franciso under Captain Niven. After being successfully canted in the river, the vessel was towed up to Finnieston Quay to get her equipments completed.

Berwick Law.—On June 2nd Mr. Robert Chambers, jun., launched from his building yard, Lower Woodyard, Dumbarton, a barque of about 1,700 tons burthen. The vessel is built to the order of David Law, Esq., of Glasgow, and will load for Calcutta. As she left the ways she was named the *Berwick Law*, by Miss Jessie Law, grand-daughter of the owner.

Cavour.—On June 2nd Messrs. Scott & Co., Shipbuilders, Greenock, launched from their shipbuilding-yard a screw steamer of the following dimensions:—Length, 208 ft.; breadth, 32 ft.; depth, 12 ft.; and 650 tons gross measurement. She will be supplied with compound surface-condensing engines of 100-horse power nominal—the cylinders being 23 and 50 inches respectively. The steamer has been built to the order of Messrs. Lamport & Holt, Liverpool, and is intended for the Brazilian coasting trade. As the vessel left the ways she was named the *Cavour*.

Pallas.—On June 7th Messrs. Alexander Stephen & Sons launched from their yard at Linthouse, Govan, an iron screw steamer of the following dimensions:—192 by 26 by 14, and classed 100 A1, with compound surface condensing engines, having cylinders 26 in. and 47 in. diameter by 30 in. stroke. The vessel was named the *Pallas*, by Miss Grace Horne, Port Glasgow. The *Pallas* has been built to the order of Messrs. Jex & Co., New York, and is specially designed and fitted up for the fruit and passenger trade between New York, Honduras, and other Central American ports.

Galatz.—On June 9th, Messrs. A M'Millan & Sons, launched, at Dumbarton, the French mail steamer *Galatz*, 1,600 tons register and 1,400-horse power. The *Galatz* will form one of the fleet of Messrs. Fraissinet & Co., of Marseilles, and is intended for service in the Mediterranean. She is the first of four steamships building by Messrs. M'Millan for the same owners. The *Galatz* was named by Monsieur F. Rolland, Marine Superintendent of Messrs. Fraissinet's fleet.

Pieter de Coninck.—On June 11th, Messrs. Alex. Stephen & Sons launched, at Linthouse, an iron screw steamer of about 3,500 tons, built to class 100 A 1, with awning deck, and fitted, before launching, with engines having cylinders 44 in. and 80 in. diameter, by 48 in. stroke. This steamer is for Messrs. Theodore C. Engels & Co., of Antwerp, and is intended for the trade between Antwerp and New York. She is specially adapted for the trade, and has accommodation for a few first-class passengers, and arrangements for a large number of emigrants, besides the most approved appliances for working cargo, carrying cattle, &c., and is also fitted with Emerson, Walker & Co.'s patent direct-acting steam windlass with their patent self-acting compound frictional brakes fitted, steam steering gear, provision for water ballast, &c. The vessel was named the *Pieter de Coninck* by Mrs. Dunn, wife of the Belgian Consul.

Abeille IX.—On June 13th, Messrs. Cunliffe & Dunlop launched from Inch Work, Port Glasgow, a twin screw tug steamer, built to the order of Messrs. A Wolter & Co, Havre, as an addition to the fleet of the Compagnie des Abeilles of that port. Her dimensions are as follow.—Length, 125 ft.; breadth, 19 ft.; and depth, 13½ ft. The engines of the new steamer will be capable of exerting 300-horse power each, or 600-horse power collectively, and will be able to propel the vessel at a high rate of speed. In addition to high engine power and speed, the vessel is fitted out forward, for the conveyance of passengers, with a large saloon. The towing arrangements provide not only for the towing of large vessels at sea, but for taking six to eight vessels up the river from Havre to Rouen. The ceremony of naming the vessel *Abeille IX.* was performed by Miss Sommerville, of The Manse, Irvine.

Gelert.—On June 14th Messrs. John Fullerton & Co., shipbuilders, Merksworth, Paisley, launched an iron screw yacht, of 120 tons, built to the highest class at Lloyd's, and to the order of Albert Wood, Esq., Bodlondel, Conway. Her engines, of 35-horse power nominal, have been fitted on board by Messrs. De Winton & Co., of Caernarvon. The whole of the deck fittings are of teak, she has a spacious deckhouse with promenade on top, and cabin under deck. Accommodation is provided for Officers and Crew in cabins abaft of engine-room. She is supplied with steam windlass, screw steering-gear, Chadburn's patent telegraph, and all the latest improvements. On leaving the ways the yacht was named *Gelert* by Miss Fullerton, Merksworth.

On June 17th, a new iron hopper dredger of 1,800 tons, built and engined by Messrs. W. Simons & Co., was launched from their works at Renfrew. It is the property of the Otago Harbour Commissioners, and will dredge from 3ft. to 35ft. depth, and carry 1,400 tons of its own dredgings. It is fitted with twin screws, two sets of compound engines, collectively of 700 indicated horse power, centrifugal pumps, and steam appliances for mooring, lifting, dredging and manœuvring. This vessel is over 200 feet in length, and is the tenth and largest hopper dredger this firm has constructed.

Allemannia.—On May 26th, Messrs. Dobie & Co., launched from the Govan shipbuilding yard another iron screw steamer, built by them to the order of the Hamburg-American Company, to the highest class, and measuring 1,900 tons. The steamer is the third one of the same type supplied to the company by the builders. As she left the ways she was named the *Allemannia* by Miss Alexander, acting for Mrs. Leitke, the wife of the Consul for the German Empire.

Cormorant.—On May 26th, Messrs. Barclay, Curle, & Co. launched at Whiteinch an iron screw steamer of 2,300 tons register for the Bird Line of Messrs. Seater, White, & Co., Leith. As the steamer left the ways she was named the *Cormorant* by Mrs. George S. Seater.

TRIAL TRIPS.

Taldora.—On May 27th, this screw steamer had a run over the measured mile at Wemyss Bay, when the guaranteed speed of 10 knots was obtained. The *Taldora* has been built by the Campbeltown Shipbuilding Company to the order of Messrs. M'Ilwraith, M'Eacharn & Co., of London, and is expected to sail in a few days for Rockhampton, Australia, where she will take up her station. The vessel is adapted for river traffic there, having a semi-awning deck fitted, also arrangements made for towing and for passengers.

Juliet.—On May 28th, the *Juliet* (s), built by Messrs. Raylton Dixon & Co., for Messrs. C. T. Bowring & Co., of Liverpool, for the Red Cross Line of steamers from the Tyne to New York, left the Builders'-yard to make her trial trip. This vessel, which has been constructed of extra strength for the Atlantic trade, is 285 ft. over all, 36 ft. beam, and depth of hold to floors is 24·6. She has water ballast in her after hold, and in a large chamber tank, which can be also used for cargo. She is built on three deck rule, two being laid, and has a long bridge amidships, under which is a saloon, and accommodation for her officers and engineers. Being intended for the cattle trade, she has been specially arranged for the protection of cattle by a long shelter deck as a continuation of the forecastle, and also has iron beams over the upper deck aft, to which temporary shelter boards can be fixed to protect cattle on this part of the ship. She has also a hood aft for the protection of the steering gear, and under this are cabins for the cattle-keepers. In the 'tween deck forward is accommodation for fifty emigrants, and the crew are lodged under the forecastle. Her outfit contains all the latest improvements, such as iron lighthouses on the forecastle, Higginson's steam "quarter-master," and all Board of Trade passenger requirements, also Sir W. Thomson's patent compasses. She is fitted with engines of 200-horse power by Messrs. Thomas Richardson & Sons, of Hartlepool. At high tide she proceeded down the river, made a run in the bay, and thence left for Dundee, where she will call on her way to New York. A large number of emigrants for America left Middlesbrough with her.

Stormcock.—On May 30th, the new iron-screw steamtug *Stormcock*, built by Messrs. R. and H. Green, Shipbuilders, Blackwall, London, to the order of Messrs. Holland, Doust & Co., Gravesend, left the Brunswick Pier, Blackwall, to run on her trial at the measured mile, Long Reach. This vessel is one of the largest screw tugs ever built for plying on the River Thames. Her dimensions are as follow:—Length between perpendiculars, 80 ft.; beam, moulded, 16 ft.; depth in hold, 9 ft. 3 in. She has a bridge-house amidships, and is fitted with all the latest improvements as to coal carrying, steam windlass, organ whistle, patent steering gear, slip towing hooks, signal lamps, &c. She has powerful machinery supplied by Messrs. Alexander Wilson & Co., Vauxhall Iron Works, and will be capable of towing vessels of 1,000 tons in a tideway, her engines being able to work up to 250 indicated horse power. The following result was obtained on her trial, viz.:—A mean speed of 10·74 knots with 70 lbs. of steam; all the weights being on board, it was considered very satisfactory, and beyond the estimated speed of the designers. The machinery during the trial worked with perfect smoothness, and the trial in all respects gave the greatest satisfaction to the owners.

Carmona.—Two steam-tugs, the *Iron King* and the *Renown*, were on May 31st required to convey on board the fine steamship *Carmona*, lying in the Roads, the guests invited by Mr. William Thomson and the other owners to enjoy the trial trip. For a trial trip the weather was everything that landsmen could desire. While the heat on shore was stifling and oppressive, there was a delicious southerly breeze on the river and out at sea which braced the spirits, whetted the appetite, and put every one on good terms with himself and everybody. The party of ladies and gentlemen was perhaps the largest that ever sailed from the Tay on such an occasion, the number being estimated at from 300 to 400. Crowded on the decks of the tugs they looked a formidable company, but spread over the spacious deck accommodation of the *Carmona* there was ample room and verge enough for all to move freely about and admire the beauty of the scenery and to inhale the invigorating ozone. By a quarter-past eleven o'clock all was in readiness on board, and the *Carmona*, under the command for the day of Captain Lee, and gay with bunting from stem to stern, steamed slowly until opposite Broughty Ferry, when the speed was increased. Passing the Lightship the crew gave the usual salute, which was promptly acknowledged, and the *Carmona*, settling down as if to show what she could do, sped quickly to the Bouy of Tay, from which point to the Bell Rock, the distance of a little over nine knots was covered in about forty minutes, being at the rate of 13 knots an hour. The ensign having been dipped in response to the signals made from the Bell Rock keepers, the *Carmona's* head was turned northwards, and, approaching close to the shore near Auchmithie, the steamer sailed as far as Lunan Bay, those on board being afforded a splendid opportunity of viewing the grandeur of the line of rock-bound coast. When the lighthouse at Scurdyness at the mouth of the Southesk was in view on the larboard bow, the *Carmona* was again put about, and, making once more for the Bell Rock, a most enjoyable sail was continued till Dundee Harbour was reached between five and six o'clock. On the run back the speed of the steamer from the Bell Rock to the Bouy of Tay was maintained at the rate of 14½ knots—a result highly creditable to the builders. The *Carmona*, it may be here of interest to repeat, is the largest steamer ever constructed in Dundee. Her dimensions are—Length between perpendiculars, 350 ft.; breadth moulded, 42 ft. 6 in; depth moulded to awning deck, 35 ft. 2 in.; tons gross, 3714 46-100; tons nett register, 2447 25-100. She was built by Messrs. Gourlay Brothers & Co., and is specially designed and fitted for the American cattle trade. Her engines of 380 horse-power nominal were under the superintendence of Mr. M'Farlane. With 80 lbs. of pressure they made 62 revolutions per minute, and the trial gave the utmost satisfaction to all the nautical authorities on board, as well, it may be added, as to those whose seafaring knowledge could barely distinguish the topmast from the keelson. She carries a powerful steam capstan windlass, Emerson Walker & Co.'s Patent, London. During the run up the river luncheon was served to all the guests, and it goes without saying that on such a day the most ample justice was done to the supplies, which were of good quality, and were served in abundance. The unanimous opinion was that the trial trip of the *Carmona*, thanks to the forethought and attention of the owners, from Mr. Thomson downwards, was one of the happiest and pleasantest ever enjoyed on the Tay. The *Carmona*, under the command of Captain Halcrow, sailed the next morning for Shields to load.

Clytha.—On June 2nd, this steamer, built by the Tyne Iron Shipbuilding Company, Willington Quay, for Messrs. Stephens, Mawson, & Co., of Newport (Mon.), had her trial trip from Shields. A speed of 10¾ knots was obtained. She is 220 ft. long, 39ft. broad, 15 ft. deep, and will carry 1,250 tons deadweight.

Dryburgh Abbey.—On June 8th, the screw-steamer Dryburgh Abbey, belonging to Messrs. Wood, Brothers & Co., of Liverpool, made a trial trip to sea. The wind was blowing a gale and a very high sea was running, yet the steadiness of the vessel and the smooth working of the machinery were subjects of general remark. After a satisfactory run of several hours, the steamer returned to the harbour to complete her loading for Madras. The *Dryburgh Abbey*, of the Abbey Line, was built and engined by Messrs. Wigham Richardson & Co., of the Neptune Works. She has Emerson, Walker & Co.'s patent windlass, and has been arranged in every detail of hull and machinery to suit both the American & Eastern trades.

Pelham.—The trial trip of this new steamer, of 450 tons burthen, built by Messrs. Hodgson & Soulsby, of Blyth, engined by Messrs. Smith Brothers, of Glasgow, and recently sold to Messrs. Goddard, Collingwood & Morton, of Grimsby, trading under the firm of Grimsby & London Trading Company (Limited), took place on June 21st. The steamer left Blyth for the measured mile, where the speed was proved to be 11 knots an hour. The trial gave great satisfaction to all interested. The boat steamed back to Blyth to load.

Cameta.—This paddle-wheel steamer, constructed by Messrs. Laird Brothers to the order of the Amazon Steam Navigation Company, and intended to be employed in the conveyance of mails, passengers, and cargo on the Amazon, has made her official trial trip with very satisfactory results, obtaining a mean speed on the measured mile of 12½ knots, the engines working smoothly and developing about 700-i.h.p. Like the two sister vessels, *Maud* and *Ica*, recently despatched to Brazil, the *Cameta* is 180 ft. long, 28 ft. broad, and 9 ft. 6 in. deep in hold, measuring 648 tons O.M. She carries 230 tons deadweight on a load draught of 6ft. 6in., and is fitted with direct-acting diagonal engines on the compound system, working at 75lbs pressure. The hull is arranged with special regard to service in the tropics, and has a complete spar deck, and above that a wooden awning deck or sunshade. The machinery, coal and cargo are below the main deck, which is left open, and on the spar deck are the cabins for passengers, Officers and Crew. A trial was made to ascertain the consumption of fuel, and the result showed a rate of about 9¼ tons per 24 hours, with engines working to 500-horse power, or a little under 2 lbs per i.h.p. per hour. The *Cameta* is the 13th steamer built by Messrs. Laird for the Amazon Steam Navigation Company and its predecessors, for the navigation of that river.

Notting Hill.—The large steel twin-screw steamer *Notting Hull*, whose novel arrangements have been exciting considerable interest in the Clyde and Mersey, was on June 10th inspected at the Tail-of-the-Bank previous to proceeding to Liverpool, where she completes her loading for Calcutta, her maiden voyage being under the auspices of the well-known City Line. The *Notting Hill* differs in many respects from the usual style of large ocean-going passenger steamers. Her great power, 3,200-horse power indicated, is exerted through two screw propellers. Nothing of such magnitude has hitherto been attempted outside of Her Majesty's navy, where all the largest and fastest fighting ships of recent construction have been fitted as twin screws, owing to the handiness and safety thus secured. The steamer herself, with her large oval bell-mouthed funnel, her long house on deck, her four masts at regular intervals, her side hatches and forest of derricks, presents a remarkable appearance. She is 420 ft. long by 45 ft. beam, so that in these dimensions she is exceeded by very few steamers afloat. Her depth is 26½ ft.; gross tonnage 4,021; registering net 2,616. She was built by Messrs. Dobie & Co., of steel, to Lloyd's highest class for hull and machinery. The Admiralty have enrolled her in their transport service list, and her watertight bulkheads—all extending to the upper deck—were calculated by the Construction departpartment as sufficient to float her with any one compartment open to the sea. The engines are constructed by Messrs. Jas. Howden & Co., Glasgow, and each pair consists of two compound inverted vertical direct-acting surface-condensing engines, 32½ in. diameter in high pressed cylinder, and 76 in. in low, with 4 ft. stroke. They are supplied with steam of 125 lbs. pressure from ten of Turner's patent boilers. The whole of the boilers and pipes have been pressed to 250 lbs. The coolness of the stokehole, notwithstanding the number of boilers and the pressure, is a remarkable feature of the arrangement. Her crank-shafts and propellers are of Vickers's cast steel. She is fitted with a powerful horizontal direct steam capstan windlass, Emerson, Walker & Co.'s patent. The *Notting Hill's* cabins, in a large house on deck amidships, are fitted up in a quaint old English fashion, which has a tasteful and home-like effect. The state-rooms, so often sacrificed in order to add to the display of the grand saloon, are so large in the *Notting Hill* that it has been found practicable to give each occupant a comfortable berth open to the ceiling. There are no upper berths. Every room has an unusually large window, which, being in a house on deck instead of in the ship's side, can be opened in almost any state of the weather. The bath-rooms and other conveniences are in unusual number, and excellently arranged. There is a handsome ladies' saloon at the fore end of the house, and a library of the newest works completes the attractions of the steamer for passengers.

Notes and Novelties.

THE "CONQUEROR."—Another powerful armour-clad ship, the *Conqueror*, will be launched from Chatham Dock-yard in the course of the ensuing month.

A NEW life-saving buoy is now being issued to her Majesty's Navy, which presents, it is stated, many advantages over those hitherto in use. By the employment of phosphate of calcium, upon contact with the water, a bright flame at once springs up, clearly marking the position of the buoy, both to those on board the ship and to the person overboard. This property of combustion upon contact with water has, however, one disadvantage, as it will necessitate great care in stowage, to prevent the possibility of a fire, thereby arising.

A STEAMSHIP REGISTER.—We have received from Messrs. Pile & Co., shipbuilders, &c., of Great St. Helens, a copy of their register of steamers for sale. This is a thick pamphlet, very full of useful information, and entirely unlike anything of the kind ever published before, in that it is very fully illustrated by lithographs, the drawings being for the most part longitudinal sections of ships. Many of these are folding plates. They save a great deal of description, and give an intending purchaser an accurate idea at once of what Messrs. Pile have to sell. The register is likely to prove specially interesting to yachtsmen, as it contains many illustrations of steam pleasure craft, and the drawings of these show their internal arrangement very clearly. The whole pamphlet is exceedingly creditable to Messrs. Pile.

THE NEW DOCKS, LEITH.—Last week, in presence of the members of the Leith Dock Commission, water was introduced from the sea into the new dock which has just been completed at Leith. The works, which were commenced in October, 1874, include a wet dock, a graving dock, breakwater, sheds, &c.; and the total cost will amount to about £400,000. The extent of the wet dock is about 16 2-3 acres, and the graving dock is 300 feet long, exclusive of the entrance, and 48 feet wide. It is expected that the dock will be formally opened in August next. The names "Gladstone Dock" and "Edinburgh Dock" have been suggested for the new works.

PROPOSED NEW DOCKS ON THE THAMES.—All opposition to the Bill which recently passed the House of Lords, authorizing the construction of a dock and quay walls on the River Thames, having now been withdrawn, the Bill will pass through the House of Commons unopposed. The proposed new dock will be situated at Dagenham, in Essex, some three and a half miles further down the river than the present Victoria and Albert docks, and immediately on the line of the London, Tilbury, and Southend Railway. The water space of the dock will be 75 acres in extent, with a depth of 35 feet below high water of ordinary spring tides. The quayage enclosing the above water will be upwards of two and a half miles in length, and the dimensions generally wil be sufficient to allow of the largest vessels afloat entering and turning in the dock. For the construction of it the Bill gives powers to incorporate a Company with a share capital of £1,500,000 with borrowing powers to the extent of £500,000.

A FLOATING CRANE.—There was launched on June 11th, from the yard of Messrs. Samuda Brothers an interesting novelty in mechanical appliances. This consists of a twin-screw steam vessel, travelling at five miles an hour, and carrying a steam crane capable of lifting 30 tons to a height of 60 ft. above the water and of traversing a complete circle of 47 ft. radius. The vessel is 100 ft. long and 44 ft. broad; the crane is 70 ft. high; the vessel, crane, and counter-balance are worked by steam machinery driven by separate engines, so arranged as to be under the control of one man. Provision is thus made for lifting or transporting any weight up to 30 tons from the quay or from craft into a ship's hold, or *vice versa*, in much less time than is necessarily occupied by a derrick, for masting or dismasting vessels, and for fitting out or repairing the largest ocean-going steamers. The crane and machinery have been entirely designed and constructed by Messrs. Hunter & English, of Bow, for the London and St. Katherine Docks Company's use in their Royal Albert and Victoria Docks, where the vessel can be seen at work in ten days' or a fortnight's time.

AMONG the most noticeable novelties in ship-building, we observe some vessels building in Messrs. Halsey & Co.'s Yard, Wandsworth. One large model, measuring eleven tons, and attaining a speed of eight miles per hour, with twenty people on board, the draft being only four inches. The model is to illustrate a proposed vessel for Channel service. Another vessel commenced will measure 592 tons, and is to be 45 ft. beam, the largest craft ever built above London Bridge. This craft is to be propelled by engines on the Perkins' system, to work up to 800 h.p. An entirely new form of submerged torpedo, driven by a Six-Cylinder Halsey Engine, which is capable of being steered at will, and will attain a speed of fourteen knots; the motive power, "some chemical," is the subject of a patent. The same firm has just contracted for fifteen steam launches, 120 ft. long by 20 ft. beam, with a guarded feathered propellor, for deep sea fishing in the North Sea. Also two very handsome yachts of about sixty tons, of galvanized steel, for the Mediterranean, suitable for transit *vià* the French canals. The steel has undergone immersion in a bath prepared by this firm, which enables it to maintain its malleable and ductile qualities after the galvanizing process. They have besides a large number of their smaller gigs building, one of them to work with petroleum fuel.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 20th May to 20th June, 1881.

2205. H. J. Haddan (communicated by O. C. Bjerke). Harpoons.

2223. N. G. Kimberley. Steam generators.

2240. L. A. Groth (communicated by A. E. Miller). Propelling apparatus.
2248. H. E. Newton (communicated by Cloarce & Cocharand). Rotary engines.
2251. G. Quick. Breechloading apparatus for ordnance.
2259. H. J. Haddan (communicated by O. C. Hansen). Foghorn apparatus.
2264. W. C. Barney. Electrical cables.
2271. A. Budenberg (communicated by C. F. Budenberg and B. A. Schaeffer). Gauges.
2278. A. Verity. Couplings for propeller and other shafts.
2284. G. Allibon, T. Turton, and J. Jones. Steam generators.
2289. G. Allix. Skeps or mud and grain buckets.
2291. J. Neil and J. L. Corbett. Propulsion, steering, and manœuvring of steam ships.
2327. J. Overton. Swimming apparatus.
2333. J. F. Jaquess (communicated by W. Attwood). Navigable vessels, and their propulsion and steering.
2339. W. Fraser. Ships' water closets.
2340. T. Turton and G. Allibon. Screw propellers.
2353. J. Gwynne. Cool chambers for food storing, &c., afloat and ashore.
2357. G. Peacock. Screw propellers.
2370. H. E. Newton (communicated by A. Nathan). Slide valves.
2376. C. Wenner. Equilibrium valve.
2384. H. J. Haddan (communicated by J. S. Cain). Oscillating steam engines.
2419. F. W. Panzera. Ascertaining the deflection of artillery projectiles.
2425. Sir William Palliser. Ordnance.
2435. W. Payne and W. Fisher. Safety valves.
2455. J. Sturge and J. Grubb. Mechanical foghorns.
2474. A. J. T. and R. Anderton. Steam generators.
2489. W. Loughrin. Fishing and fish nets.
2505. H. A. Bonneville (communicated by L. Planus). Propelling and steering.
2514. H. J. Haddan (communicated by G. M. Eames and others) Hatchway doors.
2519. R. R. Gray. Packages for lard, paint, &c., and closing same.
2520. J. Sexton. Buoyant life preservers and mattresses.
2523. A. M. Clark (communicated by W. M. van Wagenen). Life raft.
2532. G. E. Gourand (communicated by P. B. Delaney and E. H Johnson). Electric cables.
2544. J. B. Hannay. Applying zinc to prevent corrosion in steam boilers.
2560. W. R. Lake (communicated by J. L. Landis). Utilizing volatile liquids for the production of motive power.
2567. E. P. Alexander (communicated by J. A. Ziegler). Marine engine speed regulator.
2586. H. J. Haddan (communicated by S. Shaw). Ships' cattle pens.
2623. J. Bell, F. G. M. Stoney, and W. E. Rich. Transporting carriages and cattle over rivers, &c.
2625. J. H. Slatter. Valves.
2641. H. J. Haddan (communicated by C. Codron). Safety valves.
2652. W. J. Sage. Propulsion of rowing boats.
2656. J. Bourne. Engine governors.
2658. A. D. Roth. Life and property saving apparatus.
2661. F. Lebacq. Stool to prevent sea sickness.
2687. J. M. Gorham. Governor.
2698. G. H. Heinke. Deep sea diving apparatus.

⁂ Any information regarding these or other patents will be gladly furnished on application.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

May 28th, 1881.

Blair, Robert ...	2 C	Lvrpool.
Buttrum, Eugene	2 C	London.
Connel, John ...	2 C	do.
Gillings, William	2 C	do.
Hawkes, Thos. A.	2 C	Plymth.
Knowles, John ...	2 C	Lvrpool.
McCall, J. F. ...	1 C	do.
McIntosh, A. ...	1 C	Grnock.
Millar, J.	2 C	Lvrpool.
Noble, A.	2 C	do.
Parker, A.	2 C	London.
Potts, R.	2 C	do.
Rae, William ...	2 C	Lvrpool.
Scott, M. J. S. ...	1 C	Lvrpool.
Smith, C. E. ...	1 C	London.
Stubbs, J.	2 C	London.

June 4th, 1881.

Biggar, J.	2 C	Lvrpool.
Black, I. M. ...	2 C	London.
Boyd, D. D. ...	1 C	Glasgow
Branch, D.... ...	1 C	do.
Browey, George...	1 C	Sndrlnd.
Brown, E. F. ...	2 C	N Shlds.
Buchanan, D. ...	1 C	Glasgw.
Burlinson, F. ...	1 C	Sndrlnd.
Duguid, D. ...	1 C	Glasgw.
Hare, William ...	2 C	Lvrpool.
Jones, R.	2 C	do.
McEvan, Wm. ...	2 C	London.
Meikle, George ...	2 C	Lvrpool.
M'Leod, A. ...	1 C	do.
Morrison, Wm....	1 C	Glasgw.
Pearson, A. F. ...	2 C	Glasgw.
Pease, J. C. S. ...	2 C	Bristol.
Purves, J.	1 C	London.
Rankine, A. ...	1 C	Glasgw.
Rennies, D. C. ...	1 C	do.
Robinson, J. W.	2 C	N Shlds.
Simson, J. P. ...	2 C	do.
Storey, J. B. ...	1 C	do.
Svenson, P. G. ...	2 C	Glasgw.
Taylor, G. F. ...	2 C	N Shlds.
Wilson, J.	2 C	Glasgw.
Wilson, P.	2 C	do.
Wiseman, R. ...	1 C	do.

June 11th, 1881.

Ballantine, A. ...	2 C	N Shlds.
Burran, J.	1 C	Lvrpool.
Brick, A.	1 C	London.
Brothy, A. B. ...	1 C	Lvrpool.
Charleston, D. M.	2 C	do.
Cheddle, Joseph...	2 C	Hull.
Dalton, R. W. ...	1 C	N Shlds.
Dick, J.	1 C	Leith.
Doughty, Henry...	2 C	Hull.
Galbraith, J. ...	2 C	Glasgw.
Harris, C.	2 C	do.
Inglis, W. F. ...	2 C	Lvrpool
Key, William ...	2 C	London.
Lamb, William ..	2 C	Lvrpool.
Lewis, H.	1 C	do.
Main, I.	2 C	Leith.
Matthew, Wm. ...	2 C	Lvrpool.
McGowan, Wm.	2 C	Lvrpool.
Smiles, J. H. ...	2 C	N Shlds.
Steel, J. F.... ...	2 C	London.
Storrar, M. C. ...	2 C	do.
Sturdy, J. R. ...	1 C	Hull.
Terry, S.	1 C	N Shlds.
Thompson, T. R.	1 C	do.
Tissiman, T. ...	2 C	London.
Vernon, W. J. ...	2 C	Lvrpool.

June 18th, 1881.

Bath, J.	1 C	N Shlds.
Bilton, John J. ...	2 C	do.
Dean, John J. ...	2 C	Lvrpool.
Dodd, William ...	1 C	N Shlds.
Flindt, E. J. ...	2 C	London.
Forrester, J. ...	1 C	Lvrpool.
Gibbons, C. A....	2 C	London.
Hall, John	2 C	N Shlds.
Hooking, F. A....	1 C	London.
Morrison, A. ...	2 C	do.
Reid, William ...	2 C	do.
Smallwood, J. ...	2 C	N Shlds.
Wardill, J. J. ...	1 C	London.
Williamson, W....	2 C	do.
Smith, John ...	1 C	N Shlds.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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" " " " treble " . .	15s
" " ¼ page . . .	30s.
" " ½ " . .	60s.
" " Whole page . .	120s.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, AUGUST 1, 1881.

EDITORIAL NOTES.

WE have, it seems, by no means learnt all that propellers can teach us. The tests of the torpedo boat *Lightning* have given very marked results in favour of the new form of propeller fitted thereto. The alteration there tested is not in the form of the screw itself, but in the direction and control of the stream of water issuing from or delivered by the screw. It is well known that many of the improvements that have been sought to be effected in propellers have had for their object the better direction of the stream of water from the screw and the avoidance of churning; but the apparatus to which we refer, as fitted to the *Lightning*, serves to control the issuing stream of water by a cylinder—that is, a screw of small diameter is enclosed in a cylindrical casing, and is thus obliged to deliver an unbroken column of water in the direct axis of the vessel. So far, the apparatus is similar to that of Mr. Rigg and Mr. Parsons; but this apparatus, which is the invention of Mr. Thornycroft, has the especial feature of a long central cone, extending far to the rear of the enclosing cylinder. Fixed guide plates are also attached to the rear of the enveloping cylinder which are operated by the rudder, so that when amidships the water is delivered directly aft, but when put hard over the opposite wing closes, and the stream of water is driven towards the rudder side. This makes the vessel answer to its helm with very great readiness, so that the vessel can circle to port in 1 min. 15 sec., and to starboard in 1 min. 5 sec. As her speed, also, is over 19 knots, which is effected by a screw of 3 feet in diameter, as compared with a screw which was formerly 5 feet 6 inches in diameter, the improvement effected by the invention is a very substantial one.

So MUCH public attention has been directed of late to the tunnel under the English Channel that an almost similar, though smaller, undertaking at Liverpool has been almost lost sight of. Many years ago the project of a Mersey tunnel to unite Liverpool and Birkenhead directly was set on foot, and a pioneer company was founded for the purpose. The funds subscribed by this Company were, however, soon exhausted in preliminary borings and investigations, so that the disheartened shareholders were glad to dispose of their rights to a private firm. Messrs. Brunlees & Fox since then have been energetically carrying on the preliminary work and borings in a quiet and cautious manner. They have, however, proved by a preliminary shaft and borings that the whole course of the proposed tunnel will lie through new red sandstone of a hard and compact character. They have as preliminary work sunk two large shafts, one at each end, to a depth of 180 feet, and have driven a horizontal drift some 200 yards from the Birkenhead side, and half that distance on the Liverpool side. As the whole distance to be tunnelled is only 1,600 yards, one-fifth of the most essential part of the undertaking has already been accomplished. Messrs. Brunlees & Fox now consider themselves in a position definitely to state that no engineering difficulties need be anticipated in the tunnel beyond the usual leakage through fissures in the red sandstone bed. The minimum thickness overhead will nowhere be less than 25 feet. The leakage to be expected can be easily dealt with by the powerful pumping engines already laid down at either end. The estimated cost of the whole undertaking is only £866,000, and the work could be completed in two years. So, if promptly proceeded with, we are likely to see this effectually carried out long before its gigantic rival, the Channel Tunnel.

THERE seems to be much room for alteration for the better in the management of our dockyards. Our practical readers may have experienced, or at least can easily realise, the very great bar and hindrance to steady and effective work when the practical and technical chiefs are allowed no personal responsibility, but are entirely controlled by a head or heads which know nothing whatever of the practical work. This anomaly in management seems to exist in full force at present in our dockyards. There are under equal authority in our dockyards a ship-building officer, an engineer officer, a store-keeping officer, and a sail-making officer, with a naval officer over the whole as "manager." Such an anomaly could never exist with success in a private firm, and there can be little doubt that the effect on the Government establishment must be equally pernicious. The Controller of the Navy is now removed from the Admiralty Board, and the real authority which was once vested in the hands of the Chief Constructor by Mr. Childers when Sir E. J. Reed held that post, seems now to be dissipated in a committee and a president, one of the most unwieldy methods of management in the world. This seems to be all of a piece with the tardy recognition of the importance of the position of Chief Engineer on board ship. It may be unpleasant to the minds of admirals and captains of the old school to find their vessels now converted into gigantic engines of war, and thus to be now designed upon principles and constructed of materials of which they know nothing. But as the fact is now uncontrovertible and irrecoverable it would become them to more clearly and readily to recognize this fact, and gracefully to give the responsibility and management into the hands of those who know effectively how to deal with it.

WE see that an idea which was first promulgated some years ago has just been revived and further experiments been tried on a practicable scale. We refer to the operation of a submarine torpedo boat by electricity. A fairly successful test has just been concluded at Newport for the second time, a submarine torpedo boat having been run out from the port some distance and steered about with perfect ease, and brought back successfully to the starting point by an electric current operated from the shore. The danger to an attacking vessel if opposed by such a submarine vessel, invisible to the vessel it attacks, but entirely controllable from the shore, can hardly be exaggerated. It seems certain destruction to the ironclad. If the presence of sunken torpedoes, fired by contact or electrical discharge, can be considered a formidable defence, which they certainly are, the danger from such a submarine boat, directed at will against the attacking vessel from either side or the stem, is ten thousand times greater. In fact, the scientific and deadly means of destruction that are now being daily invented seem to point to a conclusion that naval warfare is no longer that of man to man or of courage against courage, but is of mechanical science against mechanical science. If once the direction, movement, firing of floating or submarine vessels by electricity becomes a practically accomplished fact, as it is a scientifically possible fact, we may picture to ourselves two opposing naval forces warring against each other at a distance by means of floating or submarine engines seeking each other's destruction by the directing force of electricity. The destruction on either side of these devilish inventions would practically decide the battle possibly without the loss of a man, as no ordinary ironclad could hope successfully to face such submarine infernal machines, and there would thus be but one resource for safety, namely flight.

IN our commercial marine, also, the march of scientific progress is moving fast enough to take all the breath out of the weather-worn mariners of a few years back. A steamer has just arrived in London from the Clyde, steered by electricity. The operation of the gear has been fully successful so far as the steering operations of the vessel, but an unexpected and new complication has arisen as affecting the use of electricity on board ship. The compasses were so affected as to be practically useless. If this is likely to be the case in all instances where much electricity is made use of, it will be a severe bar to the general introduction of electric lighting on board ship. We should hope, however, that some simple means of insulation from the effect of the induction of such currents, which we presume is the disturbing cause, will be introduced as a remedy, or possibly some substitution for the electrical needle as an indicator of the north pole may be invented which would not be affected by electric currents.

THE NEW DOCK AT LEITH.

THE new dock formally opened at Leith last week and henceforth to be known as the Edinburgh Dock, in honour of the Royal Duke who performed the ceremony, lies east of the Albert Dock, which is the most recent of the existing basins, having been completed in 1869. Access to it is obtained through the Albert Dock, and the connecting passage is spanned by a massive swing bridge, which is adapted both for railway and for ordinary traffic. The site, both of the Albert and of the Edinburgh Dock, has been reclaimed from the sea, and is protected by a solid reclamation bank upwards of a mile in length. This embankment is in itself a stupendous piece of masonry. The wall is 30 ft. broad at the base and 10 ft. at the top, and in its construction 100,000 tons of rubble and 8,000 cubic yards of ashlar and concrete were used. The breadth of ground reclaimed between the face of the embankment and the old foreshore varies from 1,250 ft. to 1,400 ft.—that is to say, it averages a quarter of a mile. The breadth of ground between the new dock and the sea is 225 ft., which affords ample space for sheds, lines of railway, and roadways. The view of the sea from this platform is at present shut out by a solid timber fence. When this has been replaced, as I believe it is intended to be, by a low parapet of stonework or concrete, there will be formed a splendid promenade, from which fine views will be obtained of both coasts of the Firth and of Inchkeith in the mid-channel, and on which pedestrians may enjoy refreshing sea-breezes. It will be in direct connection with the East Pier of Leith, which is at present one of the favourite Saturday walks of the citizens of Edinburgh. The pier and the embankment together will form a seaside promenade nearly two miles long, affording views of city and of coast almost unrivalled in variety and beauty. Eastward from the new dock the embankment encloses a space of upwards of 50 acres, which in the meantime will be filled in and given up to the railway companies—the North British and the Caledonian—but which may be utilized for additional dockyard accommodation, should that be necessary.

The new dock is 1,500 ft. long and 650 ft. wide; but there projects into it from the middle of the eastern end a jetty 1,000 ft. long and 250 ft. broad. At that end, therefore, the breadth of water on each side of the jetty is only 200 ft. But what is thus lost in water area is more than compensated for by the increased accommodation for berthing vessels and for wharfage and sheds. At the west end of the jetty there is a graving dock 300 ft. long. This is smaller than the Prince of Wales's Graving Dock in connection with the Albert Dock, which is 470 ft. long; but it will be a valuable addition to the conveniences of the port. The superficial area of the new dock is 16 2-3 acres. The Albert Dock, which is the largest of the existing docks, extends only to 10¾ acres. The wharfage of the Edinburgh Dock is, in linear measurement, 4,000 ft., or upwards of three-quarters of a mile. The masonry of the containing walls is of the most solid description, and is very handsome in appearance. The foundations rest on blue boulder clay—a formation eminently favourable in view of the requirements of the substantial superstructure. The northern side of the new dock will be appropriated to the coal traffic, which is expected to receive a new impetus from the convenience thus afforded to it. It is also intended to form special depots around the dock for the importation of grain, timber, flax, and other leading imports—an arrangement from which the trade of Leith will doubtless derive benefit. The whole works, including the railway undertakings, were estimated to cost £400,000. They have been carried on during the last five years by the trustees of the late Mr. Scott, under the personal superintendence of Mr. Scott, jun., Mr. Best, and their engineer, Mr. Clarke, C.E. Mr. J. Romilly Allen, C.E., representing Messrs. Rendall & Robertson, C.E., the engineers to the Commissioners, has all along worked harmoniously with the contractors. Mr. Andrew Gray was clerk of the works.

Including the Edinburgh Dock, there will now be five wet docks in connection with the port of Leith—three on the west side and two on the east of the inner harbour. All these docks have been constructed within the present century. What is familiarly known as the Old Dock was opened in 1806. The Queen's Dock, which is an extension of the Old Dock towards the west, was completed in 1817. After the adoption of free-trade policy, the commerce of the port increased rapidly, and the Victoria Dock, north of the Old Dock, was opened in 1852. During the next ten years the trade of Leith continued to grow "by leaps and bounds," and the Harbour Commissioners found it necessary to provide additional accommodation in docks and wharfage. They were forced, however, to encroach upon the sea, and the reclamation embankment now completed was begun, and the Albert Dock and the Prince of Wales's Graving Dock were completed in 1869. The additional accommodation thus provided was very soon found to be insufficient, and the great work inaugurated was commenced in 1874. When this rapid progress is considered, it will be thought that the Commissioners have only shown ordinary prudence in providing for the extension of the docks at no distant period.

INSTITUTION OF MECHANICAL ENGINEERS.

THE annual meeting of the Institution of Mechanical Engineers is to be held this year at Newcastle, on the 2nd, 3rd, 4th, and 5th August. The institution paid its last visit to Newcastle in 1869. Sir Wm. G. Armstrong was president that year, and he occupied the chair at the meetings, which were held in the Lecture Hall of the Literary and Philosophical Society. It is a remarkable coincidence that each of these visits to Newcastle should have occurred in the centenary years of great events in the history of mechanical science. The year 1869 was the centenary of the invention of the steam engine by James Watt, and the present year is the centenary of the birth of George Stephenson. Provisional arrangements for the meeting in August have been made, and the secretary of the institution, Mr. Walter R. Browne, has sent out a circular detailing them. By this we are informed that the reading and discussion of papers will take place, by invitation of the committee, in the lecture room of the Literary and Philosophical Society. The Wood Memorial Hall will be placed at the disposal of the members as a reception room by the Council of the North of England Institute of Mining and Mechanical Engineers. The North-Eastern Railway Company have kindly undertaken to provide special trains for the various railway excursions free of charge, and the chief works in the town and district will also be thrown open to the members. The proceedings will begin at ten o'clock a.m. on Tuesday, the 2nd of August, when the members will be received and welcomed by the Mayor (Ald. Angus) in the lecture room of the Literary and Philosophical Society. The address of the president, Mr. Edward A. Cowper, will follow, and at a quarter-past one the company will be provided with luncheon in the Assembly Rooms by the general committee. An hour later a special train will run to the works of Sir Wm. G. Armstrong & Co., at Elswick, and the inspection of them will occupy the time until four o'clock. Then the special train will go on to Newburn to give the visitors the opportunity of looking through the steel works of Messrs. John Spencer & Sons. Those who do not go to Newburn will proceed by special steamer from Elswick to the Swing Bridge, to see that structure. In the evening, the company will be the guests of Sir William G. Armstrong, at Jesmond Dene, where they will partake of dinner. From ten o'clock till half-past one on Wednesday, the members will be engaged with the reading and discussion of papers, and thereafter they will journey to Jarrow, where they will lunch at the works of Messrs. C. M. Palmer & Company. The inspection of the works and the return to Newcastle will fill up the interval between luncheon and the annual summer dinner, which will be held in the Assembly Rooms. Thursday, from ten in the forenoon till shortly after one, will be devoted to the reading and discussion of papers, and after luncheon in the Assembly Rooms the visitors will take a trip down the river. They will call, in succession, at the works of the Wallsend Slipway & Engineering Company, the lead works of Messrs. Cookson & Company, the Coble Dene Dock works, and finally at the new piers at the mouth of the Tyne. They will come back by special train from Tynemouth, and at half-past eight a conversazione will be held in the rooms of the Literary and Philosophical Society by invitation of the Society and of the General Committee. On Friday, the concluding day, there will be alternative excursions to Sunderland and Haydon Bridge. Those who choose to visit Wearside will arrive in Sunderland at half-past ten, and they will be shown over Monkwearmouth Colliery, Messrs. George Clark & Co.'s engineering works, the docks, the chain-testing works, and other places. Subsequently they will dine at the Queen's Hotel by invitation of the engineers of Sunderland. The Haydon Bridge division will depart from the Central Station at ten, and a few minutes after eleven they will reach the mines. Here, after having made their tour of observation, they will be entertained with luncheon by Messrs T. J. Bewick and partners. They will be back in Newcastle shortly after four. Visitors cards may be obtained on application, which will admit to the meeting, but not to works open for inspection, or to the excursions. The Local Committte, however, have arranged for the issue of a limited number of special visitors' cards, which will admit the holders to the excursions. Application for these will have to be made to the office, 10, Victoria Chambers, London, S.W. The following gentlemen constitute the Local

Executive Committee:—Mr. Percy G. B. Westmacott (chairman), Mr. John A. Haswell, Mr. F. C. Marshall, Mr. R. S. Newall, Mr. William Boyd, and Mr. J. Cartwell Ridley. The two last-named gentlemen are the honorary secretaries.

SHEERNESS DOCKYARD.

ON Wednesday, July 20th, the members and associates of the Society of Engineers visited the forts and dockyards at Sheerness, by special permission of the Secretary of State for War and the Lords Commissioners of the Admiralty. There were present about 120 members and associates and their friends, the party including Mr. Charles Horsley, president; Mr. Robert P. Spice and Mr. Joseph Bernays, past president; Mr. Jabez Church, vice-president; Mr. Robert Berridge, Mr. William Schönheyder, and Mr. Perry F. Nursey, members of council; Mr. Alfred Williams, honorary secretary and treasurer; and Mr. Bartholomew Reed, secretary. The party proceeded from London by special steamer, and were received on the dockyard landing-stage by some of the authorities, by whom they were courteously conducted over the yard and works. This dockyard is used for building, fitting, and repairing small cruising vessels, and comprises five dry docks, one closed basin, and two open or tidal ones. About 1,700 men are employed on the general work of the yard, and at the present time there is one vessel—the *Satellite*—in course of construction, one—the *Caroline*—in course of fitting out, and four are under repair. The visitors were first conducted over the engine-fitting shop which has two extensive galleries, one devoted to light fitting work, and the other to pattern making. The brass foundry and coppersmiths' shop were next inspected, after which two beam engines of 50-horse power each were shown. These engines are used for pumping out the docks, and have been on the establishment for 60 years. In the boiler shop the visitors found a number of boilers under repair for the various vessels in course of refitting, among them being those of the *Sylvia*, surveying vessel. The yard smithy contains 60 forges, several steam-hammers of various sizes, and gives employment to 170 hands. A small galvanizing shop was visited on the way to the timber shops, where wood-working machines, both heavy and light, were seen in operation preparing the timber used in the building and fitting of the ships. The fitting shop for shipwork and the chain cable testing-house were inspected on the way to the *Satellite*, which is in course of construction. This vessel is a composite sloop and will carry eight Armstrong guns of the new pattern. She is 200 ft. in length, with an extreme breadth of 38ft., and a moulded breadth of 37ft. Her draught of water is 12ft. 9 in. forward, and 15 ft. 9 in. aft, with a displacement of 1,420 tons. She will be propelled by a single screw driven by engines of 900-horse-power. The building of the *Satellite* was commenced on the 4th of October, 1880, and she is to be launched on the 13th of August. From the dockyard the visitors proceeded to inspect the fortress at Garrison Point, which commands the entrances to the Thames and Medway. This fort mounts 44 guns, ranging from the 9-inch gun of eight tons to the 12·5 inch gun of 38 tons, and including the 10-inch gun of 18 tons. After inspecting the *Hydra* turret-ship, carrying four 18-ton guns, the visitors returned to London, having passed a pleasant and profitable day.

AN ACCOUNT OF EXPERIMENTS MADE BY A BOARD OF UNITED STATES NAVAL ENGINEERS WITH SCREW PROPELLERS OF DIFFERENT MATERIAL AND DIMENSIONS APPLIED TO THE UNITED STATES FISH COMMISSION'S STEAMER "LOOKOUT" WITH THE HULL COPPERED AND NOT COPPERED.

By Chief-Engineer ISHERWOOD, U.S. Navy.

IN the refitting at the Washington, D.C., navy-yard, of the United States Fish Commsssion steamer, *Lookout*, seven screws were adapted to her, differing in diameter, pitch and fraction of the pitch used, with the view of experimentally ascertaining the best proportions of these for that particular vessel. Two of the screws being of cast iron and the remaining five of cast brass, they furnished an opportunity for observing the comparative effect of these two metals upon the economic efficiency of the screws. Further, as the vessel's bottom was covered with rolled copper during the experiments with two of the screws, while it was not so covered during those with the remaining five screws, but exposed to the water only the wooden surface of a vessel in the usual condition for coppering, the occasion was afforded to determine the effect of such coppering or want of coppering upon the resistance of the hull.

The experiments with these screws were made by a Board of Chief-Engineers of the United States Navy, which reported the data to the Bureau of Steam-Engineering of the Navy Department. The writer has taken these data, corrected and re-arranged them, and from them has made the calculations and deductions that will be found in this paper, none of which are in the Board's report.

The experimental deductions contain two novelties, namely, the effect upon the economic efficiency of screws due to their being constructed of cast brass or of cast iron, and the effect upon the resistance of wooden hulls due to having their bottom coppered or of presenting to the water a wooden surface in the usual state preparatory to receiving the copper; or, in other words, the determination of the comparative resistance to motion in water of hulls having their immersed wetted surface of copper or of planed wood. In the absence of other experiments on these points, the present ones will be of interest, taking care to discriminate that the comparison holds strictly true only for the exact experimental conditions, any variation of which would consequently vary the comparative results; but, although the experiments determine these results quantitatively for only the particular cases on trial, yet they remain qualitatively true for all cases.

Taking the resistance of a hull as composed of the resistance of its immersed wetted surface to the water; and of the resistance of the water to displacement by it, that is to say, the resistance of water to being elevated from the centre of gravity of the greatest immersed transverse section of the hull to whatever height above the water-level it may be forced by the progress of the vessel; there follows that the ratio of these two resistances will vary according to the form or model of the hull. If the hull, of given lineal dimensions, be very sharp, the larger portion of its resistance as a whole will be composed of its skin resistance or that of its immersed wetted surface to the water, while the remaining smaller portion is composed of the resistance of the water to displacement. And, *vice versâ*, if the hull be of very full form, the larger portion of its resistance as a whole will consist of the resistance of the water to displacement, while only the remaining smaller portion is due to the skin or wetted surface resistance. In the case of the *Lookout*, the hull was very sharp, exposing a great extent of immersed wetted surface comparably to its displacement; consequently the difference between the resistances of the two kinds of surface—rolled copper and planed wood—will be proportionally more marked in her than in the cases of vessels with fuller forms. However hard and smooth a wooden surface may be made out of water, yet when immersed it will become water-soaked and soft, the small exposed fibres of the wood separating, rising, and forming a delicate hairy coating, offering much more resistance to water than the original hard, plane surface from which they arose.

It is to be regretted that the experiments were so few; they might easily have been extended by cutting off two of the four blades of the screws, by successively reducing their diameters and lengths, &c., which modifications could have been executed at little cost, as the screws did not exceed 5 feet in diameter, a size readily handled yet large enough for reliable results; but, as the vessel was not entirely at the command of the Bureau of Steam-Engineering, only such trials were available as could be made without interfering with her other uses.

The experiments do not show any superiority of cast brass over cast iron for the material of the screw; from which may be inferred that, per unit of surface moving at equal speed, the resistance of the water to the cast iron surface is no greater than to the cast brass surface. Also, that the less direct resistance of the thinner cutting or forward edges of the blades of the brass screw was not sufficient to produce a sensible effect on the economic result. The much less cohesive strength of cast iron than of cast brass requires the blades of screws made of the former metal to be much thicker for equal strength than those made of the latter metal; and in the case of the experimental screws, the cast iron blades were about two and a half times thicker than the cast brass ones. Of course, the thicker blades must be attended with more direct resistance than the thinner ones, but the edges, forward and aft, of all blades are so acutely bevelled that any difference due to this cause seems to be too slight to affect the result in a marked manner.

HULL.

The *Lookout* was constructed of wood for a steam yacht, and had a light schooner rig. The bottom was uncoppered during the trials with screws *A*, *B*, *C*, *D* and *E*; but it was coppered during the remaining trials with screws *F* and *G*.

The following are the dimensions and proportions of the hull corresponding to the draught of water which was maintained without sensible variation during all the trials:—

Length on water line from forward edge of rabbet of stem to after side of the sternpost		96 feet.
Greatest breadth on waterline		13 ft. 6 in.
Extreme breadth		16 feet.
Draught of water from bottom of keel	Forward	2 ft. 9 in.
	Mean ...	3 ft. 8 in.
	Aft ...	4 ft. 7 in.
Depth of keel below lower edge of its rabbet	Forward	6 in.
	Mean ...	1 ft. 2 in.
	Aft ...	1 ft. 10 in.
Mean depth of hull from water-line to lower edge of rabbet of keel		2 ft. 6 in.
Area of the greatest immersed transverse section		25·28 sq. ft.
Area of the water-line		861·44 sq. ft.
Displacement (35 cubic feet per ton)		42·87 tons.
Displacement per inch of draught at water-line...		2·051 tons.
Ratio of length to breadth on water-line... ...		7·1111.
Ratio of the greatest immersed transverse section to its circumscribing parallelogram		0·7490.
Ratio of the water-line to its circumscribing parallelogram		0·6647.
Ratio of the displacement to its circumscribing parallelopipedon		0·4631.

ENGINE.

The vessel had one vertical, direct-acting, compound, condensing steam engine, with the two cylinders placed side by side, and acting on cranks at right angles to each other.

Diameter of the small cylinder	12 inches.
Diameter of piston rod of the small cylinder ...	1½ inches.
Net area of the piston of the small cylinder ...	112·2140 sq. in.
Stroke of the piston of the small cylinder ...	16 in.
Space displacement of the piston of the small cylinder, per stroke	1·0390 cu.ft.
Diameter of the large cylinder	20 inches.
Diameter of the piston rod of the large cylinder	1½ inches.
Net area of the piston of the large cylinder ...	313·2764 sq. in.
Stroke of the piston of the large cylinder ...	16 inches.
Space displacement of the piston of the large cylinder per stroke	2·9007 cu.ft.
Ratio of the space displacement of the piston of the large cylinder, per stroke, to that of the piston of the small cylinder	2·97178

BOILER.

There was one cylindrical boiler, with cylindrical furnaces, and horizontal fire tubes returned over them. A large portion of the steam room was in a steam-chimney or drum placed above the shell and traversed by the chimney, so that the steam in the drum was, in a measure, superheated by the escaping hot gases of combustion.

Diameter of the boiler shell	7 feet.
Length of the boiler shell	8 feet.
Diameter of the steam-chimney	4 ft. 6 in.
Height of the steam-chimney	5 ft. 6 in.
Number of furnaces...	2
Diameter of the furnaces	2 ft. 4 in.
Length of the grates	5 feet.
Area of grate surface	23⅓ sq. ft.
Area of water-heating surface, calculated for outside of tubes	519 sq. ft.
Calorimeter, or aggregate cross area of tubes, for draught	3·14 sq. ft.
Steam room in boiler shell and in steam-chimney	94·54 cu. ft.
Square feet of water-heating surface per square foot of grate surface	22·2429.
Square feet of grate surface per square foot of cross area of tubes	7·4310.

SCREWS.

The screws experimented with were seven in number, and are designated by letters from *A* to *G*, both inclusive. In the Tables hereinafter given, the columns headed with these letters contain the data and results of the experiments made with the screws of corresponding letters.

All the screws were of cast brass with the exception of screws *B* and *G*, which were of cast iron, and had blades about two and a half times thicker than the brass ones.

All the screws had four blades and a uniform pitch, which varied for the different screws from 7·50 to 9·08 feet. The mean fraction used of the pitch varied also from 0·1994 to 0·5736. The diameter of all the screws, except *A* and *F*, was 5 feet; that of *A* was 4·6458 feet, and that of *F* was 4⅔ feet.

When the vessel was at rest, a small portion of the 5 feet diameter screws protruded above the water; but when the vessel was in motion at the experimental speeds, all the screws were submerged, owing to the dropping of the stern.

The following Table shows the principal dimensions of the screws:—

Designation of the screws.	Diameter, feet.	Pitch, feet.	No. of blades.	Greatest length of screw in direction of axis. Feet.	Projected area of blades on a plane at right angles to axis. Square feet.	Helicoidal area of blades. Square feet.	Mean fraction used of the pitch.
A	4·6458	8·400	4	0·9167	5·4551	7·9447	0·3325
B	5·0000	7·500	4	1·1875	10·1693	13·5266	0·5283
C	5·0000	7·500	4	0·5208	5·2457	6·7860	0·2703
D	5·0000	8·625	4	0·4461	3·8697	5·3470	0·1994
E	5·0000	9·000	4	0·8125	6·8975	9·3407	0·3549
F	4·6667	9·000	4	0·8125	5·9659	8·6850	0·3539
G	5·0000	7·900	4	1·2708	11·0098	14·8453	0·5736

(*To be continued.*)

THE RELATIVE CORROSION OF IRON AND STEEL.*

By Mr. WILLIAM PARKER, Chief Engineer-Surveyor of Lloyd's Register, London.

(*Continued from page* 78.)

BRIGHT DISCS.

TABLE I. gives the loss of metal per square foot per annum. This was obtained by dividing the total loss of weight of each disc by its exact area (about ¼ of a square foot) and by the total period during which each set was exposed, which includes the time that the boilers were empty or not in use. Table II. was compiled from Table I. by dividing each of the losses in the different columns by the loss of the respective Lowmoor plates, so that the different sorts of iron and steel can be readily compared. Looking at Table II., under the heading of "Cold Water," and in the third column, which gives the mean values of the relative losses in the sea and bilge water, it will be seen that there are but two metals—Bowling iron and Messrs. Brown's steel—which corroded more than Lowmoor iron; and although the average loss of steel is a little greater than that of iron, the difference is so slight that for practical purposes it is safe to assume that bright steel exposed to the sea or bilge water corrodes no faster than bright iron, especially than the better qualities of iron. When exposed to the atmosphere, although there is no great difference between the common and the better sorts of iron, the steel appears to have lost considerably more than either

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* Read at the Spring Meeting of the Iron and Steel Institute

Lowmoor or any other iron; and the same is the case with those discs exposed to the action of boiler water with or without zinc. But although the absolute losses of both iron and steel is least, the relative difference of losses of steel and iron is greatest in the boiler in which zinc is used. Here the steel has lost about 50 per cent. more than Lowmoor iron, and Lowmoor iron 50 per cent. more than Bowling iron, or 40 per cent. more than the average of the other irons. On referring to Table I., column 4, it will be seen that the average losses per square foot are very small, and that the greatest loss of steel (Messrs. Brown's) in the boiler with zinc was less than the smallest loss of iron (Bowling) in the air, and far less than the Bowling iron in the other two boilers.

TABLE I.

Absolute Loss of Iron and Steels in Pounds per Square Foot of Bright Surface per Annum.

	Cold Water.		Atmosphere, London.	Boilers.		
	Sea. B.	Bilge. C.	A.	Zinc in Boiler. D.	Collier Boiler. F.	P. and O. Boiler. E.
Parkhead common iron	·190	·415	·156	·058	·566	·195
Skerne common iron	·137	·556	·151	·062	·485	·203
Common iron mean	·163	·485	·153	·060	·525	·199
Leeds forge best iron	·168	·475	·169	·061	·609	·164
Taylor's best iroh	·169	·527	·155	·066	·657	·191
Bowling best iron...	·225	·518	·150	·052	·598	·193
Farnley best iron	·173	·573	·167	·069	·708	·217
Lowmoor best iron	·212	·539	·166	.087	·597	·209
Best iron mean	·195	·526	·161	·067	·633	·194
Landore mild steel	·208	·480	·206	·120	·666	·234
Brown & Co.'s mild steel ...	·215	·560	·254	·147	·755	·310
Bolton Co.'s mild steel	·198	·544	·214	·117	·785	·250
Steel Co. of Scotland's mild steel	·207	·509	·222	·132	·739	·253
Mild steel mean	·207	·523	·224	·129	·736	·262

Note.—A loss of 1 pound per square foot per annum is equal to an average loss of $\frac{1}{40}$th inch of thickness per annum.

Returning to Table II., we observe in column 9 that the steel with one exception, has on an average corroded only about 1 per cent. more than the Lowmoor iron, which has always been considered as amongst the most suitable for the internal portions of boilers, and which has corroded about 20 per cent. more than the ordinary irons. So that, although the present experiments confirm the prevailing impression that bright mild steel does corrode faster than iron when we get from cold sea-water to the condition of a marine boiler, the difference is not so great as to establish the matter beyond question. I have here specimens of the steel and iron discs out of the boiler containing zinc. You will observe that the surface of these specimens is only a little rough, and that the corrosion is very uniform, which is the case with all the bright plates exposed in this boiler. The plates exposed to the atmosphere are slightly rougher, but also uniform, while those suspended in the boiler of the Peninsular and Oriental Company's vessel are roughly and more irregularly corroded. It is not a little surprising to find that it is only amongst the discs exposed in this boiler and those exposed to the bilge water that any deep pitting has taken place. There were four cases, of which I produce two specimens, which are very distinctly pitted. These were Farnley iron and Messrs. Brown's steel. The one contains a pit mark about 1-16th of an inch deep, and the others pit marks not quite so deep. The plates submerged in the sea were irregularly attacked, and rather patchy. Those exposed to the bilge water looked still worse, the black plates now and again containing pit marks, and the fibres of the iron in many cases being distinctly visible. The plates exposed in the boiler of the coasting vessel had accidentally come adrift, and the insulation was thus destroyed within the last

TABLE II.

Comparative Loss of Iron and Steel, Taking Loss of Lowmoor Iron as Standard.

	Cold water.			Atmosphere, London.	Boilers.				Mean of columns 1, 2, 4, 5, 7 and 8.
	Sea. B.	Bilge. C.	Mean of B. C.	A.	Zinc in boiler. D.	Mean of F, E.	Collier boiler F.	P. and O. boiler. E.	
Parkhead common iron	·90	·77	·83	·94	·67	·94	·95	·93	·86
Skerne common iron	·64	1.03	·83	·91	·72	·89	·81	·97	·85
Leeds forge best iron	·79	·88	·83	1·01	·70	·90	·102	·78	·86
Taylor's best iron	·93	·98	·95	·93	·76	1·00	·110	·91	·90
Bowling best iron...	1·06	·96	1·01	·90	·60	·96	·100	·92	·91
Farnley best iron	·82	1·06	·94	1·00	·79	1·11	·119	·104	·98
Lowmoor best iron	1·00	1·00	1·00	1·00	·100	1·00	·100	·100	·100
Landore mild steel	·98	·89	·93	1·24	1·38	·112	·112	·112	1·12
Brown's mild steel	1·01	1·04	1·02	1.52	1·69	·137	·127	·148	1·33
Bolton's mild steel	·93	1·01	·97	1·28	1·55	·125	·131	·120	1·18
Steel Company of Scotland mild steel ...	·97	·94	·95	1·33	1·52	·122	·124	·121	1·20

ten weeks of their immersion, and they do not show the action of the water so distinctly as in the other cases. No pitting has occurred, but the structure of the iron has in one or two instances been conspicuously brought out. The Lowmoor disc placed in this boiler also showed very marked projections, one of which, about two square inches in area, contained a thin red scale of what proved by analysis to be copper. The hardening of the plates, by punching the numbers, in no way affected the corrosion of the bright discs, but the glass ferrules protected the part of the disc with which they were in contact when exposed to the atmosphere and bilge water. Curiously enough, however, in some of the cases in the boiler containing zinc, and in the sea, there was found to be considerable extra corrosion in the neighbourhood of the glass.

TABLE III.

Analyses of the Respective Materials of which the Discs were made.

Description of Metal.	Manganese.	Carbon Colour Test.	Sulphur.	Phosphorus.	Silicon.	Copper.
Parkhead common iron	trace.	·09	·027	·316	·020	·06
Skerne common iron	·01	·10	·027	·193	·100	·021
Bowling best iron	trace.	·12	·005	·136	·013	·04
Farnley best iron	03.	·14	·028	·085	·110	0·31
Lowmoor best iron	trace.	·11	trace.	·101	·100	0·16
Taylor's best iron	·01	·11	·012	·096	·090	0·16
Leeds Forge best iron	·01	·10	·022	·142	·120	0·22
Landore mild steel	·64	·18	·074	·077	·013	0·15
Brown & Company's mild steel	·11	·12	·074	·056	trace.	trace.
Bolton Company's mild steel	·52	·19	·068	·041	·060	trace.
Steel Company of Scotland mild steel ...	·26	·10	·035	·057	·032	trace.

Note.—The discs analysed were the bright ones of series F, which, as already stated, was suspended in a boiler supplied with water from a point in the Tyne where it is probably acidulated by the refuse from one of the local copper works.

Black Discs.

With the black discs the glass had also protected parts of those discs subjected to the influence of bilge water and the atmosphere, while it had caused strong local corrosion on every one of the discs immersed in the sea and on about half of those exposed in the boiler containing zinc; and perhaps a still more curious circumstance is that almost throughout the experiments the glass ferrules wasted more than the metals. The stamping of the numbers, which, unavoidably caused some of the scale off, had an injurious effect on the plates exposed in the sea and the bilge, although the local corrosion from this cause was only slight in all the other cases.

Table III. shows the results of the analyses of the several bright discs contained in series (F).

TABLE IV.

Ratio of Unprotected Metallic Surface of Black Discs to Total Surface after Exposure.

	Cold Water.		Atmosphere. London.	Zinc in Boiler.	Hot Water.		Mean of Columns. 1, 2, 3, 4.
	Sea. B.	Bilge. C.	A.	D.	Collier Boiler. F.	P. and O. Boiler. E.	
Parkhead common iron	·70	·80	1·00	·60	1·00	1·00	·77
Skerne common iron	·30	·50	·90	·50	1·00	·90	·55
Leeds Forge best iron	·45	·85	·80	·80	1·00	1·00	·79
Taylor's best iron	·25	·50	·70	·30	1·00	·90	·44
Bowling best iron	·50	·90	1·00	·70	1·00	·95	·77
Farnley best iron	·30	·80	·95	·80	1·00	1·00	·71
Lowmoor best iron	1·00	1·00	1·00	·95	1·00	·98	·99
Landore mild steel	·30	·60	·50	·35	1·00	·90	·42
Brown's mild steel	·50	·80	·97	1·00	1·00	—	·82
Bolton mild steel	·15	·80	·50	·70	1·00	1·00	·54
Steel Company of Scotland mild steel	·40	·80	1·00	·70	1·00	1·00	·72
Mean loss of scale due to stamping and exposure exclusive of Lowmoor	·38	·73	·74	·54	1·00	·96	—

To enable us to compare the corrosions of the black plates, it is necessary to divide the loss they sustained not by the total surface of the discs, but by the surface of the bare metal only. The percentage of exposed to total surface of each disc was therefore ascertained as nearly as possible, and will be found in Table IV. A perusal of this Table shows that, neglecting Lowmoor iron, which lost almost all its scale, the least scale has come off those discs immersed in the sea, namely, about 30 per cent; next comes the series D, which was exposed in the boiler containing zinc, with 50 per cent., followed by the two sets exposed to the atmosphere, and in the bilges with an average of 70 per cent., while the plates in the boiler of the Peninsular and Oriental steamer lost 95 per cent. Those suspended in the boiler of the coasting vessel lost all their scale, but this is easily accounted for by the fact that the glass ferrules broke during the last ten weeks of the exposure, thus allowing the discs to rub against each other. Taking the mean values of the figures in columns 1, 2, 3, and 4, it will be seen that the Lowmoor iron has lost all scale; that Bowling iron, Leeds Forge iron, Parkhead iron, and Brown's steel have lost about 80 per cent.; Farnley Iron and Steel Company of Scotland steel about 70 per cent.; Skerne iron and Bolton steel about 55 per cent.; and Taylor's iron and Landore steel about 40 per cent. It should be mentioned, however, that in stamping the numbers before the experiments it was observed that the Lowmoor scale appeared to be the softest, and fell off more easily than any other, while the other scales adhered better, but with different degrees of tenacity. With the help of Table IV., and the accurately ascertained loss of each black sample, and also the losses per annum per square foot of bright samples, as given in Table I., we are able to compare the average depth of corrosion of the bright discs, and that of the black discs where the scale has been removed. These results are given in Table V.

TABLE V.

RATIO OF AVERAGE DEPTH OF CORROSION OF BLACK DISCS TO BRIGHT DISCS.

	Cold Water.		Atmosphere, London.	Zinc in Boiler.	Hot Water.	
	Sea. B.	Bilge. C.	A.	D.	Collier Boiler F.	P. and O. Boiler. E.
Parkhead common iron	1·2	·9	1·1	1·8	·9	1·0
Skerne common iron	3·3	1·2	·8	2·1	1·0	·5
Leeds Forge best iron	2·4	1·0	·8	1·6	1·0	·8
Taylor's best iron	3·1	1·1	·8	3·1	1·1	·6
Bowling best iron	1·8	·8	1·0	2·5	1·1	·9
Farnley best iron	3·0	·5	·9	1·3	1·0	·9
Lowmoor best iron	·9	·9	1·1	1·3	1·1	·9
Landore mild steel	3·0	·9	·7	1·8	1·2	·9
Brown's mild steel	1·8	·9	1·0	·9	1·0	—
Bolton mild steel	·6	·6	·5	1·0	·9	·9
Steel Company of Scotland mild steel	2·2	·8	1·1	1·1	1·0	1·1

Without knowing how long the scale had been off, it is of course impossible to form a correct measure of the rate at which the black oxide might have been acting galvanically upon the neighbouring bare patches, but the comparison is worth making, so far as it goes, and it certainly tends to confirm the belief mentioned by Mr. Barnaby and others, that a rather strong galvanic action does go on between the scale and the patches of bare steel in its neighbourhood. Looking to the importance of this point, it is to be hoped that it will be further followed up and scientifically analysed, as it seems to be, from these experiments, of quite as much importance as has been attributed to it. I have now endeavoured to lay before the meeting the results of the series of experiments which it has been my privilege to make. I do not for a moment pretend to be able to account for all the peculiarities that have arisen. Some degree of capriciousness was to be expected from those plates on which the scale was left, but I must confess I was hardly prepared to see so much difference between different steels and between different irons under precisely similar conditions, as proved to be the case. It would, perhaps, not be far wrong, speaking generally, to say that the different pieces of iron differed as much among themselves as they did from steel; and certainly the effect produced on my mind, after carefully weighing the results of the experiments, has not been to raise any apprehension that steel boilers or steel ships are likely in the future to corrode to any serious extent more rapidly than iron. Having made these experiments, however, I desire to say that I do not think undue importance should be attached to any experiments of the kind made on a small scale. The most they can do is to indicate tendencies, and perhaps suggest remedies and precautions earlier than actual experience, which necessarily takes some years to accumulate when a new material is placed under trying conditions. The only real test, however, and the only one that will be finally accepted, is that of practical experience with the boilers themselves. We have at the present time some 1,100 marine steel boilers running, the majority of which come periodically under the inspection of the Engineer-Surveyors of Lloyd's Register, and although they have received instructions to give these boilers special attention and to note carefully any peculiarities they may discover, the accounts I have received from them down to the latest, go to show that the steel boilers behave, in respect to corrosion, about as well as iron boilers. In one or two vessels also, where an iron and a steel boiler are working under identical conditions, there is nothing to point to the conclusion that the iron will outlast the steel one. Greater irregularity in the corrosion of the steel is reported, and I am inclined to the belief that this is due, even to a greater extent than shown in the experiments, to the unequal action of the scale, and if it should be found necessary hereafter to remove the scale, the difficulties in the way would not be great, and much of the irregularity and pitting would doubtless be removed. This I know is being done to a limited extent in boilers. The Admiralty also have taken steps to remove the black scale from their ships, and I have heard of at least one firm intending to follow their example. At any rate, I feel sure this meeting will hear with satisfaction that neither from the series of experiments which I have described, nor from our daily experience up to the present time, is there any reason to believe that the question of corrosion is likely to form a bar to the extended use of steel for marine boiler-making purposes. Difficulties may arise, and some unexpected results may be found, but the difficulties will, in my opinion, be easily removed, and the members of this Institute will, I am sure, welcome any one who will lay before them unexpected results, and will assist him in obtaining an explanation of them.

MILD STEEL IN FRENCH ARSENALS.

On the Use of Mild Steel for the Construction of the Hulls of Ships in the Arsenals of the French Navy.

By M. MARC BERRIER FONTAINE, Member.

(*Continued from page* 88.)

As regards the calculations of tensile strength, it appears from the results of the tests which have been already carried out in considerable number, that we may adopt the mean figure of 48 kilogrammes per square mm. as representing the ordinary breaking strain of steel plates and moulded bars such as are actually used in the French Navy. The ordinary breaking strength of the iron plates and moulded bars of ordinary and common quality which are delivered to it cannot, on the other hand, be regarded as greater than 36 kilogrammes per square mm. at the outside. For iron we generally use a factor of safety of 6, that is to say, that we look upon 6 kilogrammes per square mm. as the limit of the load that we consider proper to put upon it in shipbuilding. Using the same factor for steel, we reckon that plates and moulded bars of this metal may be safely loaded with 8 kilogrammes per square mm. The limiting loads of 6 kilogrammes and 8 kilogrammes per square mm., which have just been mentioned, are to one another as 1 :

1.33, consequently the inverse ratio of 1 to 0.75 indicates the reduction of thickness, and, therefore, of weight which the substitution of steel for iron allows us to introduce into the plates and moulded bars which we use. This corresponds to an economy of 25 per cent. in the weight of a hull of given dimensions and form. In order to take account of the loss of strength experienced during the work—a loss which, as we know, may well be of greater relative importance in steel than in iron—and in order to take account of the existence of an inferior limit below, which we cannot reduce the thickness of steel plates without risking their buckling, and although there does not exist any general formal rule about this, the constructors of the French Navy, in agreement with the authorities of Lloyd's Registry, think that it is not safe to reckon on a final saving of more than 20 per cent. in the replacing of iron by steel in the weight either of the whole hull or of any part of it. The total amount of this reduction being thus fixed, the French Navy has never experienced the slightest difficulty in procuring plates and moulded bars of steel of suitable thicknesses or scantlings to secure this saving of weight. As several engineers have very justly remarked at the preceding meetings of the Institution, if the reduction of 20 per cent. were to be uniformly and separately applied to the thickness of each of the pieces which entered into the construction, doubtless there might be some difficulty in getting at it; but it is easy in the practical application of this reduction to introduce numberless compensations, and consequently to reach the desired reduction on the whole of the construction. In accepting the tenders for the French Navy, care is always taken to specify for the plates the weight per square metre, and according to the thickness in millimetres, and for moulded bars the weight per metre run; these fundamental weights being always calculated on the supposition that the plates and moulded bars of steel have a mean specific gravity of 7·8. We specify, moreover, that the weights thus indicated are never to be exceeded. The only departures which are permitted are in defect, and of this the following are the limits generally adopted: For moulded bars of every section, 5 or 6 per cent., accordingly as their scantlings are greater or less; for plates of 1½ mm., 12 per cent., this margin of 12 per cent. diminishing by 1½ per cent. for every mm. of extra thickness up to 5 per cent. for plates of 15 mm. and all greater thicknesses. It is finally stipulated that these thicknesses are only pointed out as mere approximate guides. These arrangements practically come to ordering both plates and moulded bars by weight and not by thickness. The French makers, whose interest it is to keep as nearly as possible to the higher limit pointed out to them in each case, seeing that the plates and moulded bars are paid for by their actual weights, have, like their colleagues in England, never found the slightest difficulty in executing orders given to them under these conditions.

A very important question, which has already been discussed during the preceding meetings of the Institution, especially in 1878, in the able communication of Mr. Martell, "On Steel for Shipbuilding,"[*] is one that concerns the interests that shippers may have from a strictly commercial and economical point of view in exchanging steel for iron in the construction of their ships. The examples quoted by Mr. West show clearly that the actual cost of a ship built in steel was still, three years ago, considerably greater, in the proportion of 9 to 8 nearly, than that of a ship of similar form, and the same external dimensions, built of iron. The choice of steel for the construction of a ship could thus only bring about under these conditions, as the practical result, an economy, as Mr. Martell has endeavoured to explain to us, from the greater profits which such a ship would bring if built in steel, thanks to a larger proportion of total weight remaining disposable for cargo. The discussion which took place brought out that, at any rate at the time we are speaking, of the practical advantage that could thus be realized by shippers was still far from being uncontested. Without entering afresh into the discussion of the very different opinions which have been held on this point, I will content myself with bringing under notice how much this divergence of views loses its importance if we look to the future, and that undoubtedly the immediate future. It is, in fact, permissible to predict, almost with certainty, that the price of plates and moulded bars will continue to get lower and lower pretty rapidly, and that consequently the time will soon have come when the cost of a ship built in steel will not exceed that of a ship of similar form, and of equal dimensions, built of iron. We are even free, having regard to the increasing experience, skill, and ability of workers in steel, to predict that in the not very distant future, plates and moulded bars of steel (of which the manufacture requires even now, after all, neither more nor less handiwork nor more fuel than that of plates and moulded bars of iron) will ultimately cost no more for steel than for iron. The advantages of the use of steel in the construction of merchant ships will not then fail to be completely appreciated by all charterers without exception, who will be in a condition to profit by it to secure ships presenting in comparison with ships of iron of similar form and equal external dimensions the following various causes of superiority: a lower cost price, a much lower weight of hull, and consequently an effective paying tonnage increased in the same proportion, and finally a hull built of more ductile material, and therefore less liable to receive serious injury from grounding, from slight collisions, and so forth, from which no ship can be guaranteed. For the French Navy, which uses exclusively iron of the best quality, and of which the price is considerably greater than that of the iron employed in building merchant ships, the time has already come at which the hull of a steel ship comes out at a lower price than the hull of a ship of similar shape and equal dimensions, built of iron. This result is due to the considerable reduction that the price of steel has undergone within eight years, and in consequence of which the prices of steel plates and angle irons are now sensibly equal to or even rather below those of iron plates and angles. This does not quite hold, it is true, for steel bars other than angle irons. The price of these is still higher in the proportion of 1·76 to 1, or thereabouts, than that of similar bars of iron. That is an anomaly which I find some difficulty in explaining, but which time and the increased competition between the different works will doubtless not be long in causing to disappear. However this may be, the moulded bars we are speaking of only enter a very little into the total weight of a ship, and their higher actual price is even now an insufficient set-off to the savings which result on the whole of the construction, from the replacing of iron plates and angles by steel plates and angles, of which the price is considerably lower than formerly, and whose total weight, moreover, may be 20 per cent. less.

(*To be continued.*)

TRIAL TRIP OF THE "ALMIRANTE BROWN."

THE *Almirante Brown* is a twin screw armour-clad corvette, built by Messrs. Samuda Bros. for the Argentine Republic. She was launched 6th October, 1880, and fitted with engines and boilers by Messrs. Maudslay & Co., Lambeth.

She is a vessel of moderate size, combining all the latest improvements in construction, armour, and armament. The hull of the vessel is built entirely of Siemens' steel; the armour is "compound" or steel-faced, consisting of an armour belt 9 in. thick at water-line, and 6 in. thick below water, extending 120 ft. in length, and protecting the engines, boilers, and magazines. There are cross bulkheads at the ends of the belt, which reach from 4 ft. below the water line to the main deck. Above the main deck amidships is an armour-plated battery with double embrasures at the fore end, and containing in all six guns. The thickness of armour on the battery sides is 8 in. and 6 in.; that on the ends 7 in. and 6 in. The armour plates on the belt and battery are worked on a teak backing averaging 10 in. thick. The armour plates are secured to the vessel with bolts and nuts, screwed from the inside, and so arranged as not to wound the steel face of the armour. Horizontal armour of steel plates 1½ in. thick is worked from the battery to the ends of the vessel, forming a shell-proof and watertight deck 4 ft. below the water, protecting the steering apparatus, &c. The bottom of the vessel is covered with teak planking 3 in. thick, and zinc sheathing as a protection against fouling. The vessel is fitted with a double bottom, and divided by transverse bulkheads and steel decks into numerous water-tight compartments. The vessel is rigged with two pole masts, giving an area of sail of 10,000 square feet.

The ship is 240 feet long between the perpendiculars, 50 ft. beam, and 21 ft. 11 in. deep from the underside of the main deck to the garboard strake. She can stow 650 tons of coal, sufficient to supply the vessel when steaming at a moderate speed—say of 10 knots per hour—for eighteen days, and enabling her to travel 4300 miles.

Her armament consists of six 8 in. breech-loading 11½-ton guns in battery, capable of throwing a projectile of 180 lb. These guns are so placed that they can be fired in a line parallel with the line of keel, one 8 in. 11½-ton gun at bow, one 8 in. 11½-ton gun at stern. These guns are all constructed on the latest breech-loading principles, and mounted on wrought iron carriages and slides, manufactured by the makers of the guns, Sir William Armstrong & Co., of Elswick. Four 12-centimetre breech-loading guns with hydraulic Albini carriage and slide on upper deck, and two ditto on battery deck; two 9-pounders for boats and field carriage for ditto for use on shore. She is propelled by two pairs of inverted compound surface condensing engines; high-pressure cylinder 52 in. diameter, low-pressure cylinder 90 in. diameter; stroke 3 ft. 3 in.; diameter of crank shaft 13¾ in.; of crank pins 14 in.; length of connecting rod, 6 ft.; steel piston rods 8¼ in. diameter; one air pump to each set of engines 41 in. diameter; two feed pumps ditto 6 in diameter, two bilge pumps ditto 7¼ in. diameter; condensing surface 9000 square feet. Each pair of engines works its own screw, and is fitted in a separate engine-room. The boilers are eight in number—oval tubular. The boiler-room is divided into four separate water-tight compartments, and the machinery is so constructed that should three of the compartments be disabled the other compartment will remain intact with its complete set of pipes and valves. There are eight boilers and twenty-four furnaces. The diameter of the furnaces is 3 ft. 3 in. There are 283 tubes in each boiler 3 in. diameter, and 6 ft. 6 in. between tube plates. The grate surface is 507 square feet; the heating surface 13,674 square feet; the pressure on the safety valves 65 lb. per square inch. The engines are provided with Durham's patent velometers for preventing racing at sea.

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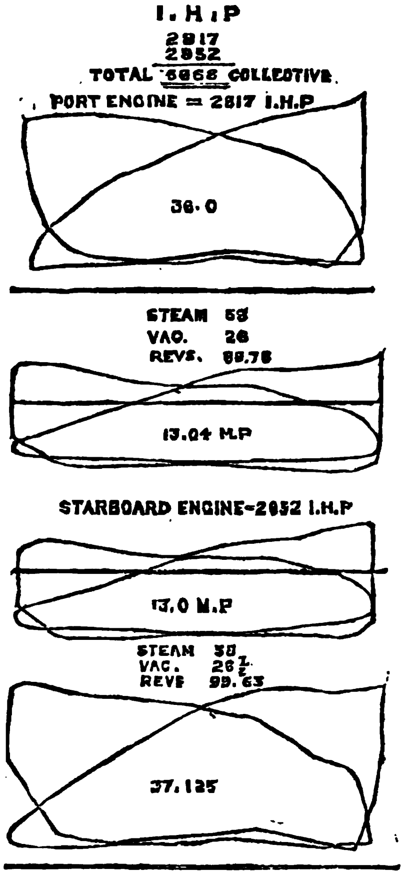
[*] Transactions Institution Naval Architects, vol. xix., 1878, pp. 7, *et seq* See also the discussion by Mr. C. H. Wigram, Mr. W. Denny, and others pp. 24, &c.



On her measured mile trial at Maplin sands, on 14th June, 1881, she attained the following results:—

Draft forward 18·6 } = 19·2 mean and 4237 tons displacement
Draft aft 19·10 ... } and 833 ft. M. S.

Runs.	Knots.		
1 up	15·789		
		13·914	
2 down	12·040		14·021
		14·128	
3 up	16·216		14·158
		14·187	
4 down	12·162		13·977
		13·806	
5 up	15·451		13·991
		14·177	
6 down	12·903		——— Mean of means
			56·167 + 4 = 14 042

Revolutions ... ... 90·05 Indicated horse-power 5400

On her six hours' trial of 16th inst., the vessel being in all respects as before, the mean indicated horse-power was 5470, revolutions 89½. So that more power and more revolutions were maintained continuously for six hours' time, than on measured mile.

The detailed particulars of the ship's six hours' run may be thus stated:—The vessel left the Royal Albert Docks on Monday, June 15th, about 12 noon, and proceeded down the river at an easy speed to Sheerness, where she was anchored and lay for the night. The stokers for the trials were lent from Chatham Dockyard by the Admiralty, and were sent on board early on Tuesday morning, June 16th, in charge of an engineer and doctor. His Excellency Senor Manuel Garcia, the Argentine Minister, and a numerous party, including Admiral Sir Houston Stewart, Mr. J. D. A. Samuda, Mr. Joshua Field, Commodore Cordero, Captain Urubey, the secretary of the Argentine Legation, Mr. J. Wright, engineer-in-chief of the Admiralty, Mr Telford Field, Mr. G. Duncan, Mr. Walter Maudslay, Mr. W. Hales White, Assistant Constructor of the Navy, and designer of the vessel, Mr. Kelson, and a number of gentlemen connected with the Argentine Government, left Victoria by special train soon after eight, reaching Sheerness about half-past nine. The vessel started as soon as all were on board, and proceeded to the measured mile at the Maplin Sands. Six runs were made, with the following results:—

	Time.	Speed.	1st Means.	2nd Means.	
	m. s.	Knots.			
1st mile	3 48	15·789			
			13·914		
2nd „	4 59	12·040		14·021	Mean revolutions, 90·05
			14·128		
3rd „	3 42	16·216		14·158	Mean I.H.P. of the six runs, 5399·65
			14·189		
4th „	4 46	12·168		13·997	
			13·806		
5th „	3 53	15·450		13·991	
			14·147		
6th „	4 39	12·903		56·167 + 4 = 14·042 knots mean [speed	

It will thus be seen that the maximum power developed during the trial was 5790·79 horses—1290 horse-power over the contract (4500). On both occasions the engines were in charge of Mr. Duncan and Mr. Warriner. The working of the machinery was perfect, and although driven for seven hours at the highest speed no water service was required, nor was there any sign of hot bearings. At the conclusion of the trial the vessel proceeded to Greenhithe, where she anchored for the night. Nothing could be more satisfactory than the manner in which the machinery worked throughout, the average horse-power developed being over 900 in excess of the contract.

Mr. J. D. A. Samuda, in presiding at the luncheon on board, gave the toast of "*The Almirante Brown*," and stated that the corvette was the first vessel built entirely of steel, and at the same time having a coating of steel-faced armour. Nothing has hitherto been built of the same displacement, and with the same power of artillery as the *Almirante Brown*, which has attained the speed, averaged in the six runs, of over 14 knots.

The corvette then returned to her moorings at Sheerness, and lay there until Thursday, June 16th. She started again at half-past ten on that morning, and steam having been got up to the full pressure the half-hourly observations were commenced at 11·15, with the following results:—

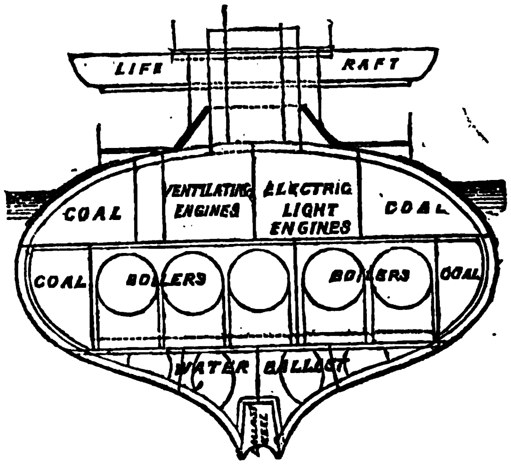
Half-hours	Boiler Pressure.	Revolutions.		Vacuum.		Indicated H. P.		Total I. H. P.
		Star.	Port.	Star.	Port.	Star.	Port.	
1st	59	87	88·26	26½	26½	2617·68	2667·19	5284·80
2nd	55	87·33	88·53	26½	26½	2593·53	2472·70	5066·23
3rd	58	89·1	90	26½	26½	2700·11	2694·20	5394·31
4th	58	88·83	89·76	26½	26	2730·91	2688·16	5419·08
5th	60	90·6	90·9	26½	26	2815·51	2974·68	5790·19
6th	58	89·63	89·76	26½	26	2821·04	2830·74	5651·79
7th	58	89·5	90·4	26½	26	2815·10	2807·41	5622·52
8th	59	89·8	90·6	26½	25½	2771·98	2772·09	5544·88
9th	59	88·8	89·3	26½	25	2767·75	2590·30	5358·06
10th	59	89·76	90·36	26½	25	2856·98	2738·20	5595·18
11th	59	89·13	90·26	26½	26	2689·85	2722·02	5411·88
12th	60	89·3	90·2	26½	26	2749·09	2750·71	5499·80

We give carefully reduced copies of diagrams taken from the engines when indicating 5668 horse-power collectively.

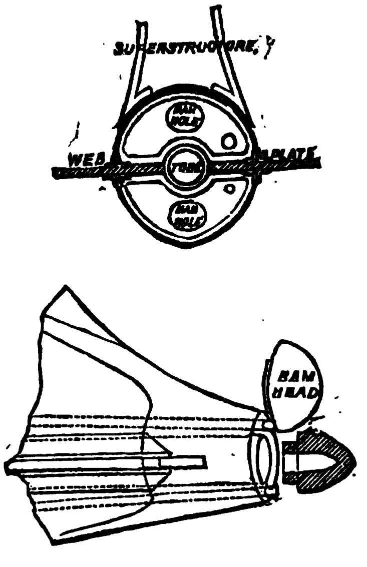
THE "POLYPHEMUS."

In our issue of July last we gave a description of the launch of the *Polyphemus* at Chatham; in the present number we give further particulars with engravings. The principal dimensions of the vessel are:—Length, 240 ft.; extreme breadth, 40 ft.; draught of water, 19 ft. 6 in. forward and 20 ft. 6 in. aft; and displacement 2,640 tons. The upper deck, or turtle-back deck as it is called, is 4 ft. above the water line along its middle; but the form of the vessel is such that it curves down and enters the water at an angle of about 45 deg., so that according to the usual acceptation of the term the ship has no free-board whatever. A light superstructure forecastle is raised to a height of 4 ft. 6 in. above the turtle-back to keep the bow up when the vessel is steaming at full speed, and upon this anchors and other fittings are placed. There is also a low superstructure aft to form a platform to walk upon and to give finish to the vessel. Between these two superstructures a wash strake is fitted so as to give a good sight line and to carry hand rails.

The water will sweep across the upper deck even in moderate weather; no attempt is made to keep it from doing so, but as in all the low-sided war vessels in the British Navy the principal hatchways are trunked up to a flying deck from which alone the interior of the vessel will be accessible at sea. The flying deck is 10 ft. 6 in. above the upper deck, and therefore 14 ft. 6 in. above the water, and it extends between the forecastle and the platform deck aft. There is only a handrail around the flying deck, bu three of the four hatchways which are trunked up open into circular deck-houses fitted with covers or hoods 6 ft. or 7 ft. above the deck; the fourth trunk contains the funnel with its casing and air spaces which also extend several feet above the deck, and may be closed in when required. The foremost trunked hatchway is divided into three by partition bulkheads, one, by far the largest of the three ways, leading to the forward part of the ship including the torpedo-rooms and magazines, and the two smaller ones leading to each of the two forward stokeholds. The deck-house over this trunk will form the forward pilot tower, and will contain the steering wheel and the various implements for working and fighting the ship. The middle deck-house stands over a trunked way which is also divided into three by partition bulkheads; two of these lead down to the aftermost stokeholds and the third to the foremost engine-room.

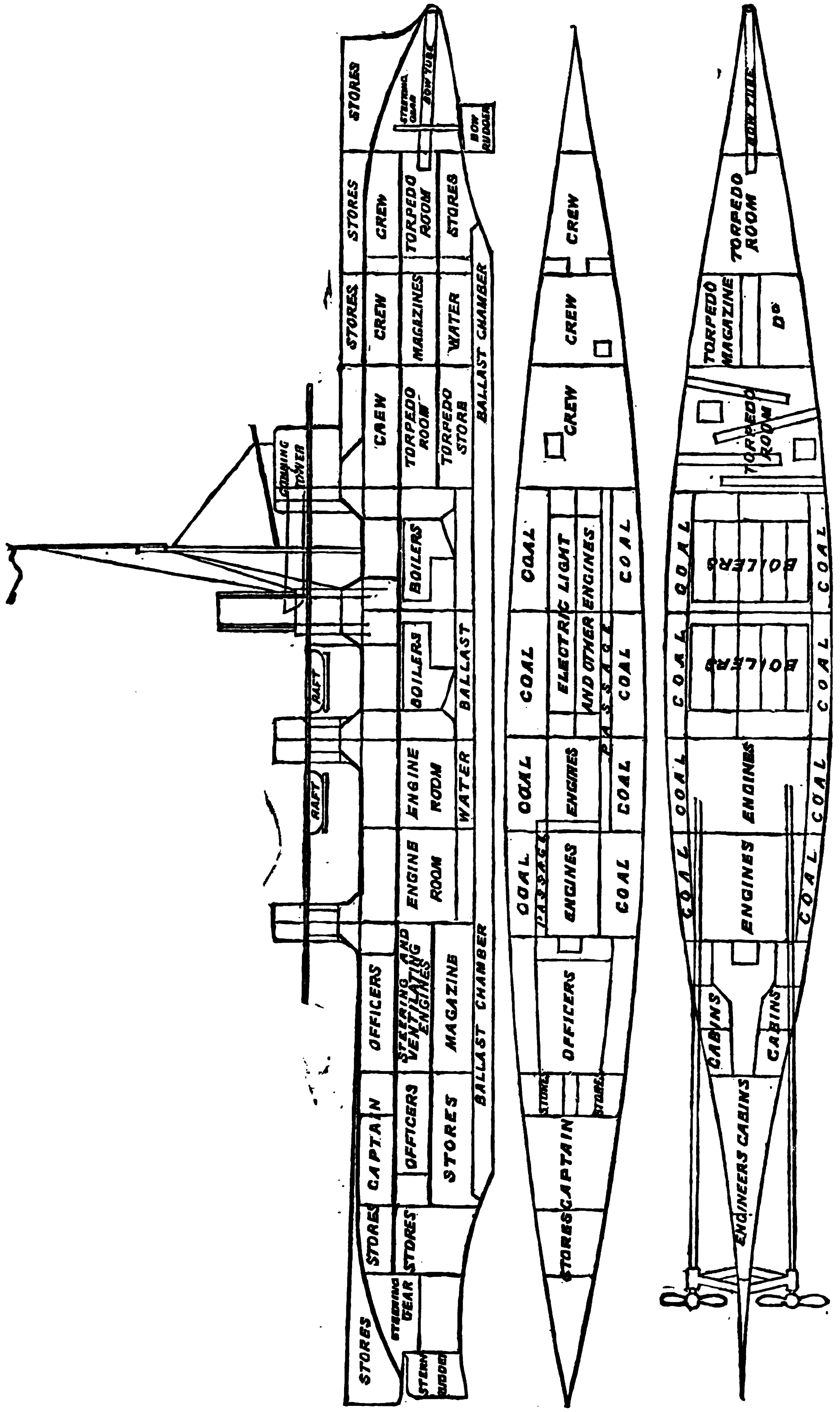


Midship Section.



The Ram Head, showing how constructed, carried and secured.

The aftermost trunk is divided into two, one passage leading down to the after part of the ship, and the other to the after engine-room. The deck-house over this trunk forms the after pilot tower, and will be similarly fitted to the forward pilot tower. The central deck-house may also be used as a pilot tower, but it will have no armour. The six Nordenfelt guns will be mounted in separate


STORES
STEERING GEAR
BOW TUBE
BOW RUDDER
CREW
TORPEDO ROOM
STORES
MAGAZINES
WATER
TORPEDO STORE
BALLAST CHAMBER
CONNING TOWER
BOILERS
BALLAST
RAFT
ENGINE ROOM
WATER
OFFICERS
STEERING AND VENTILATING ENGINES
MAGAZINE
CAPTAIN
STERN RUDDER
COAL
ELECTRIC LIGHT AND OTHER ENGINES
PASSAGE
ENGINES
TORPEDO MAGAZINE
D°
CABINS
ENGINEERS CABINS

SECTIONAL ELEVATION AND PLANS OF THE MAIN AND LOWER DECK.

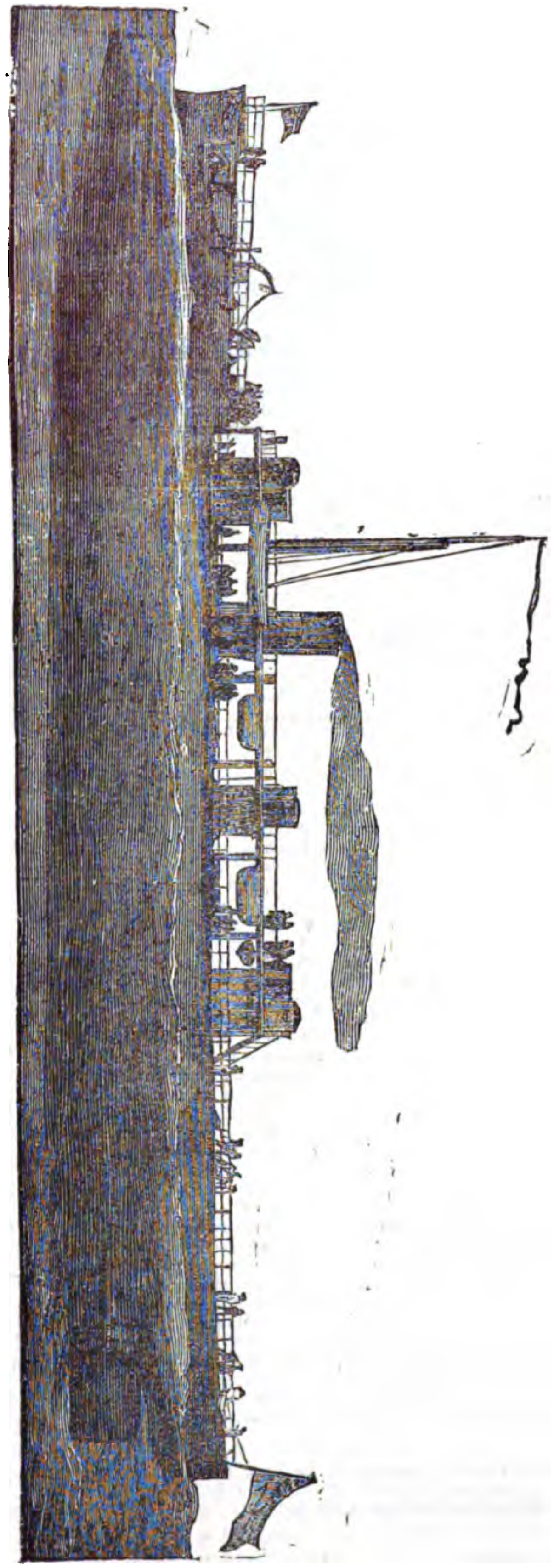
revolving turrets carried upon projecting framework at the level of the flying deck. There will be three of these on each side, one at the fore end of the flying deck, one at the middle, and the third at the after end.

The ship will carry four boats, two by davits from the flying deck ready for use, and two others kept lashed up under the flying deck aft. She will also be fitted with two life-rafts and gear for launching them in any weather.

Over the side of the turtle-back deck, to a depth of from 4 ft. to 6 ft., there are 3 in. of steel armour made up as follows:—Two ½ in. thicknesses of Landore-Siemens steel, one of which may be regarded as the skin of the ship; upon these is a 1 in. thickness of Whitworth fluid-compressed steel, which will stand a strain of 45 tons per inch, and upon this again there is a 1 in. thickness of hard Whitworth steel, also fluid-compressed, worked in plates 10 in. square, which are tested to a strain of 68 tons. The two outer thicknesses of the side plating were supplied by Sir Joseph Whitworth in compound plates already bolted together and worked to shape, and only requiring to be fastened on the ship. The plates forming the under inch thickness are all 10 ft. long and 2 ft. 6 in wide, so that each required thirty-six 10 in. squares or scales, as they are called, to cover it. The scales are secured with coned steel screw bolts, one at the centre of each of the plates, and one at each of the corners, so as to hold each of the four adjacent plates. Along the middle of the turtle-back deck the 10 in. scales are not fitted, so that here the armour is only 2 in. thick. The bases of the trunks from the hatchways to the flying deck are protected by a glacis of 6 in. steel-faced armour to a height of 3 ft. 6 in. above the deck; and the entire front of the foremost trunk is protected by 8 in. steel-faced armour, which also extends to a height of about 5 ft. above the flying deck, and gives protection to the pilot-tower.

Those who are at all accustomed to considering the requirements of a vessel of this character will not be surprised to observe from the diagrams how completely filled the ship is with necessary fittings and stores, and how very little space is left for providing even requisite accommodation, to say nothing of ordinary comforts, for the officers and men. Excepting the low superstructure forecastle there is no space above water available either for the stowage of stores or for accommodation, and this in a ship of 2,640 tons, and with engines of 5,500 indicated horse power, and having an available depth of hold of about 15 ft.; whereas in an ordinary ship of this displacement and power, space for nearly the whole of the accommodation and much of the storage would be found above the boundary at which the hull of the *Polyphemus* ceases. The 103 men who form the crew may manage to live in the limited spaces allotted them forward on the main deck, but they will barely be comfortable, notwithstanding the elaborate ventilators both for conveying in fresh air and for removing foul air which pass along overhead and considerably limit the area over which it is possible to stand upright. The officers also will fare but little better in their quarters on the main deck aft; their accommodation is not luxurious. The round turtle-back form of the upper deck indicated on the midship section is preserved forward and aft; indeed it is sharper towards the extremities, so that out towards the sides of the living deck both forward and aft it will be impossible to stand upright.

The whole of the central portion of the vessel over about one-third of the length is taken up by engines, boilers, and coal. The boilers are placed low down in the ship below the main deck; they are arranged in four water-tight compartments, three in each of those on the starboard side, and two in each of those on the port. Over



THE POLYPHEMUS.

them on the main deck are placed the ventilating fans, electric light engines, and various other small engines. There are two separate engine-rooms, one before the other, the forward set of engines working the port screw and the after set the starboard crew. The coal (250 tons) is carried in sixteen bunkers. The only communication below the upper deck between the compartments before the boilers, and those abaft the engines is along a passage on the main deck, which is walled in with plating on either side and top and bottom, so as to form a water-tight tunnel. The various boiler and engine-room compartments are accessible through water-tight doors leading from this passage, as well as from above, as already described. The vessel has two collision bulkheads to keep back the water in case her strongly framed bow should be strained in ramming. The chase torpedo tube extends from the ram to 2 ft. or 3 ft. abaft the inner of these collision bulkheads, and opens on the lower deck. Here the loading of this tube will be effected. Proceeding aft on the lower deck the next compartment is allotted to torpedo magazines. Abaft this again is the main torpedo chamber, where there are four tubes, two on each side. Independent air-compressing machinery will be carried in each of the torpedo chambers; each of which chambers will also carry a number of torpedoes ready for use; the main store of torpedoes will, however, be carried in the hold under the floor of the main torpedo chamber. The main magazines for the Snider and Nordenfelt ammunition are in the after hold, but it is also intended to fit a small magazine for Nordenfelt ammunition forward. Besides the keel ballast, which may be cast loose at pleasure, a considerable weight of water ballast will usually be carried in the inner bottom compartments under the boiler and engine rooms.

Whether the *Polyphemus* will be able to crush in the side of her enemy with her long pointed ram without her bow tube being so injured as to make it unfit for use, is doubted by most persons competent to give an opinion on the subject. The bow, however, is very strong, and great care has been taken to give the tube every chance of escaping uninjured. The tube proper is placed within an outer tube of great strength, against which, however, it does not rest except at its extremities; the outer tube being rigidly attached to and forming part of the framing of the bow. By continuing the armour down and attaching it to deep web plates which extend into the outer tube and out to 18 inches beyond the skin of the ship, an arrangement of great strength has doubtless been made. The front of the tube is a massive forging which is continued aft, above and below the tube, and is well able to take care of itself. The ram-head also is of fluid-compressed steel, and is almost solid; when in place it extends into the tube several inches, so that against all blows from the front it is firmly held by the forging just referred to. The ram-head is worked from inside the ship by a steel rod to which it is fixed, and when in place it is also held by a rod below.

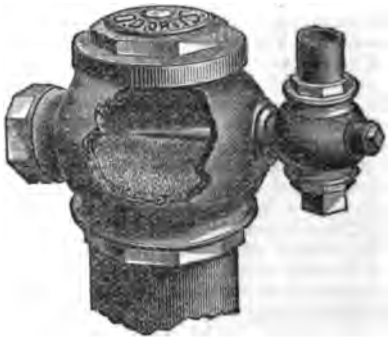
Two auxiliary balanced rudders are fitted forward, one on each side of the bow torpedo tube. They are carried upon strong vertical shafts by which they are worked, and when not required are drawn up into trunks within the hull. When in use these rudders may if desired be coupled up with the engine working the stern rudder, and all three rudders worked together.

It is confidently anticipated that a speed of 17 knots will be attained at the measured mile, but it can scarcely be hoped that the vessel will be able to sustain this speed for many consecutive hours. The distance she will be able to cover at her six hours' trial of continuous steaming will really be the measure of her capabilities in this direction. A consideration of vital importance in this vessel is her manœuvring power. Her only modes of attack being the torpedo and the ram, she must necessarily constantly endeavour to come to close quarters with the enemy, or to keep out of range of his guns. With a speed of 17 knots she will be able to elect whether she will fight or not with almost any ship at present afloat, and supposing she chooses to fight, the chance of her success will depend almost entirely on the rapidity with which she will be able to close in with the enemy, and having closed in with him, to manœuvre around him, so as to bring her torpedo tubes successively into the line of fire and within range, and also to use her ram. The vessel will doubtless possess the power of turning rapidly; the powerful rudders at both ends of the ship, and the cutting away of the fore foot and the after "deadwood" or heel will insure this, but the question of the degree of handiness can only be settled satisfactorily by actual trials.

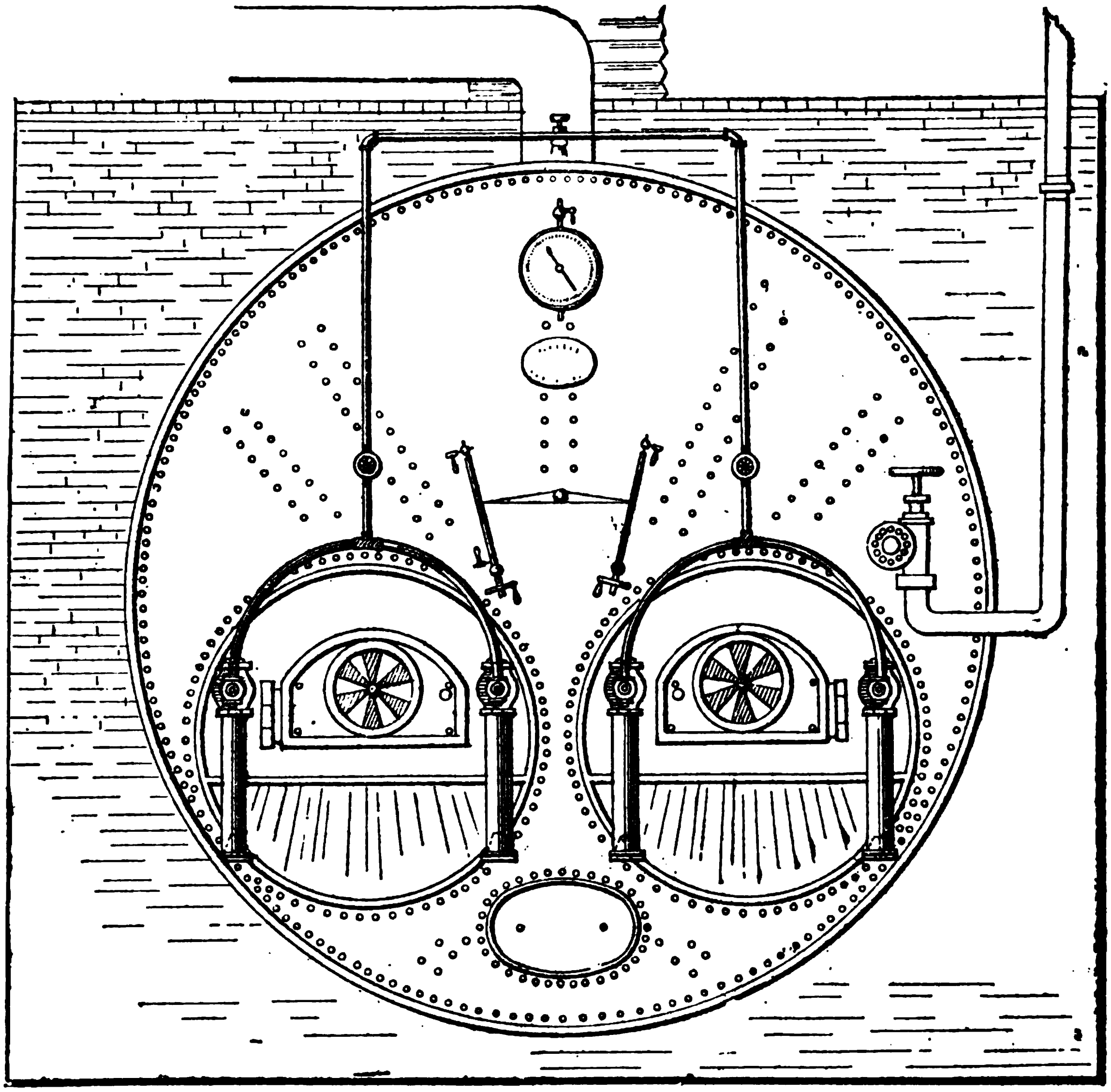
THE keel of a large steamer to be built to the order of a French firm, has been laid down at the iron shipbuilding yard of Messrs. Hodgson and Soulsby, at Blyth.

THE ORVIS SMOKE-CONSUMING AND FUEL-SAVING APPARATUS.

WE recently attended a practical demonstration of this important invention, which bids fair to eclipse all that has been previously attempted in the way of consumption of smoke, combined with economy of fuel. Mr. Orvis' improvements, though practically tested in the United States some year or so since with very satisfactory results, and are largely worked there, have but very recently been introduced on *this* side of the Atlantic; and we have refrained from giving a description of the invention until applied and thoroughly tested here, as there is a difference between English and American boilers, and steam-users might fairly argue that the success of the invention in America was no criterion of its prospects here. The invention has recently been applied to a boiler at the works of Mr. Fredk. Sage, Gray's Inn Road, London, W.C. Our illustration shews the boiler to which the consumer has been applied, and of which the following is an outlined description. The pith of the invention consists in Mr. Orvis having devised a method of supplying the furnace *with just enough oxygen of the air and hydrogen of steam to unite with the volatile hydrocarbons and other products of combustion arising from bituminous coal, and so as to form a mixture of carburetted hydrogen and olefiant gas, which readily ignites at a temperature of about* 800°, *and burns with a bright clear flame, creating perfect combustion.*



Mr. Orvis takes dry steam from the boiler, and conducts it through a small pipe down and across the furnace-front, over the fire-doors, as shewn, and branching off into two fine steam jets in front of each fire-door, which serve to draw the air up through pipes of larger diameter—open at the lower end—into an air chamber in a brass globe, at the top of each of the four large pipes or cylinders, and, a vacuum being created, the commingled air and steam is forced through other pipes into the furnace, and over the surface of the fuel, on a line converging towards the centre of the furnace. The



THE ORVIS SMOKE-CONSUMING AND FUEL-SAVING APPARATUS.

accompanying woodcut illustrates one of the brass globes used for injecting the oxyhydrogen current into the furnace. A portion of the globe is represented as being broken away, in order to shew the position of the steam-jet in the air-chamber. The commingled air and steam is distributed over the surface of the fuel, producing what the inventor terms his *surface draft*, and a valve is used to regulate the pressure, or to cut the steam off at will.

Mr. Orvis says, very reasonably, that he does not claim to be the first to introduce steam and air into a furnace to aid combustion, but he *does* claim to have discovered the correct combination of all the gaseous and æriform substances used; to use less steam than any who have preceded him, and to obtain, by his new and peculiar manner of applying the same, more perfect combustion and better results than have ever been attained before.

Mr. Orvis' invention was applied on the 2nd ult. to Mr. Sage's boiler; and, though so short a time has elapsed since it was affixed, we understand that a substantial saving in the cost of fuel is already apparent while the *smoke-burning* capabilities of the invention are apparent to any one who will visit Mr. Sage's premises, as, on the "burner" being started, the smoke is positively "killed," the chimney being absolutely smokeless.

Another great advantage attending the adoption of this apparatus is that whereas, in Mr. Sage's case, he had previously, owing to defective furnace arrangements, been obliged to burn expensive steam coal, at a cost of 16s. per ton, he informs us that he can *now* burn the commonest slack, at a cost of only 10s. per ton; and as the boiler in question requires about three tons of fuel per day, this would shew a saving of something like 18s. per day with the working of this one boiler. The invention has been widely adopted in the United States for *marine* boilers, and doubtless ere long it will find a similar application in this country. We shall watch its progress in that direction with considerable interest, and hope to refer to it again in these pages. We shall look forward also to seeing Mr. Orvis' invention included doubtless amongst the exhibits at the exhibition to be held at South Kensington, October 24th to November 26th, of the various appliances for preventing smoke, and obtaining heat with the least possible noxious products.

SUFFIELD'S PATENT FRESH WATER DISTILLING APPARATUS.

We have recently inspected a novel and very efficient arrangement of fresh water distilling apparatus, invented by Mr. G. Rayner, of the firm of Messrs. Suffield, Railway Copper Works, James-street and Devonport-street, Commercial-road, East, London, E., and of which the firm named are the sole proprietors and manufacturers. The apparatus is volutical in its internal circulating construction; and, from its extreme simplicity, compactness, and portability, it is particularly adapted for use on board ship. The mode adopted for fixing the internal parts is such as to render it practically impossible for the fresh water and salt water to become mixed. The ***rapidity*** with which the distillation is effected in this apparatus and the fact of the resultant water being ***absolutely fresh***, augur well for its coming largely into use for the Marine Service; and we purpose, in our next issue, giving illustrations and results of the working trials of this speciality just being introduced by Messrs. Suffield.

LUMINOUS PAINT.

This useful invention, which is due to the late Mr. W. H. Balmain, a chemist, well known as the originator of several important chemical processes, and founder of the Greenbank Alkali Works, St. Helen's, Lancashire, cannot be brought too prominently under the notice of shipowners, as its application for marine uses is one of the points of the greatest value in its favour. The inventor, after many years of study and experimenting, succeeded in producing a substance which would practically serve the purpose of a light for dark places; for though there is no novelty in the production of a mere phosphorescent compound, to keep luminous for a very brief period only, it is to the late Mr. Balmain that the credit is due of producing a really useful light-holding powder, to be made up and used as a paint, which takes up or *stores* the daylight to which it is exposed, and emits the same in the dark: for instance, if a board or piece of sheet iron be covered with this luminous paint, and exposed to ordinary, diffused daylight or strong artificial light, it will, when taken into any dark place, say the hold of a ship, give sufficient light to enable objects to be distinguished.

At the time of Mr. Balmain's death he had not then completed the experiments he was conducting, and they were taken up and concluded by Messrs. Ihlee & Horne, of 31, Aldermanbury, London, E.C., who have succeeded in getting the invention applied practically for various uses, and on a large scale, especially considering that it has been comparatively so recently introduced. Availing ourselves of an invitation received from the firm named, we attended at their offices a short time since to satisfy ourselves of some of the uses to which this "*bottled daylight*" (as it has been termed by a contemporary) may be put. The room used for demonstrating the application of the invention was made perfectly dark, all daylight being carefully excluded; the ceiling, however, had been painted with three coats of the luminous paint, and we were surprised to find the amount of light which this must have collected and stored up, as the light emanating from the ceiling was sufficient to render plainly discernible the various objects in the room; amongst others a life buoy, a clock dial, shewing the hands and figures very distinctly, and a variety of labels and notices, such as "Mind the hatchway," and so on. Another demonstration of a different nature interested us particularly: into a room—from which all light also had been excluded, but not painted with anything but the ordinary paint, and the ceiling whitewashed—was brought a large square of glass, the back of which had received several coats of luminous paint, and which rendered the room light enough to discern the various objects in it. To utilize and adapt this latter application on board ships, and especially in ***dangerous*** as well as ***dark*** places, such as powder magazines, lamp and spirit rooms, &c., portable boards or sheets of thin metal, or glass painted with the luminous composition, act as lanterns; as, after being taken into the daylight and exposed for a few minutes to the light, they may be carried into the dark places to which access is desired. Again, at night-time these portable painted boards or lanterns may be taken to a safe place, and charged with artificial light, by holding before a ship's lantern, and then be carried, charged with luminosity, into the dark or dangerous places.

For marine uses we consider the invention of the utmost value, and we are pleased to find that this view is taken also by our Admiralty, who have, together with other public and administrative bodies, interested in naval matters, adopted the luminous paint. We understand from Messrs. Ihlee & Horne that one of the most recently received orders is one for 600 ft. of their paint to be placed on the stern of H.M.S. *Lord Warden*. We are pleased to find also that the Southampton Harbour Board have recently passed a resolution that all their life-buoys on the quay are to be painted in future with it, and that the Trinity House have ordered channel and river-buoys to be similarly painted for Harwich and the Thames. We note also that the steam fire-engine float, *Beaver*, lying off Cherry Garden Pier, below London Bridge, is to have a band of luminous paint 18 in. wide all round bulwarks.

Though we have confined ourselves to the *marine* applications of Mr. Balmain's invention, we need scarcely add that it is of course adapted for an infinite variety of applications on land, and we are glad to find it is largely and deservedly adopted.

SANITARY PAINTS.

THE attention of sanitarians, shipowners, and others having, during the last few years, been directed to the encouragement of practical improvements upon the old and highly noxious white lead, and the many other injurious pigments used in painting and decorating, has resulted in the introduction of numerous preparations with this object in view:—the *latest*, however, is one which is especially deserving of notice in these pages.

Messrs. Griffiths, Berdoe & Co., of 51, South John Street, Liverpool, and 34, Leadenhall Street, London, E.C., the proprietors of the Sanitary Paints, have for many years devoted themselves to the improvement of the ingredients of ordinary paints, and have established for themselves a deservedly wide spread reputation in this respect. The manufacturing premises of the Company in Eaton Street, Liverpool, are on a very large scale and additions thereto, will, we understand, shortly become necessary: the premises are fitted with all the newest and most approved descriptions of chemical and mechanical appliances; a notable feature in connection with the works being the chimney shaft, which has a height of 325 ft. and is 36 ft. diameter at the base.

The productions of the Sanitary Paint Company are both numerous and various. We only specialize here, however, those which come within our province to notice as regards *Marine* applications, viz., "Griffiths' Patent White." In addition to this taking at the Paris Exhibition of 1868 the highest distinction conferred upon paints, it gained in the same year the special Richardsonian Medal of the Sanitary Institute of Great Britain; the Duke of Northumberland, the president, remarking at the time that he might with justice designate this innocuous substitute for white lead, as "the greatest discovery ever made for preventing the dreadful suffering caused by the use of lead paints." It is not for us to detail the further honours which have been bestowed upon Messrs. Griffiths' discoveries and their productions, but we come now to the practical features of the same as regards the painting of ships especially. We take as our authority Dr. Bartlett, one of our most eminent analysts who, in a Paper read by him on Griffiths' White Paint, at the Social Science Congress at Cheltenham, stated that he was earnestly desirous to see it very shortly in general use, inasmuch as he was assured that it "never causes illness to those engaged in its manufacture, that those who may be called upon to *use* it, will never be subjected to those diseases which are so deleterious to painters; that the pigments mixed with it do not produce any ill effects when freshly applied, and furthermore, that they do not lose their colour." The same authority in speaking of some experiments he made with this paint, remarks, that ordinary paints permit rust to accumulate beneath them, and therefore *scale off*, but *this* paint forms a *chemical combination with the iron*, and rust does not occur under it, therefore it does not scale off. Dr. Bartlett proceeds, "Griffiths' White when employed to paint iron vessels, is reported to stand salt water in a highly satisfactory manner, the iron being found to be unaffected by rust. This compound also resists the heat of boilers, and those who have used it affirm that the iron is always protected by it, which is by no means the case when red lead paint is used." Such evidence as the preceding forms a strong recommendation in its favour for marine uses and the more especially also, as we are informed by the proprietors that the body or covering power of this paint is about double that of white lead, and its cost is of course proportionately less.

The "Enamel Paint" is a non-poisonous preparation in all varieties of colour, which may be used to dry either with a gloss without the necessity for any varnish or with a dead surface, where a gloss may be *un*desirable. It is non-porous, and therefore damp proof, we understand also, that it successfully withstands the effects of steam, and arrests oxidation which should render it well adapted for marine uses.

The other specialities of Messrs. Griffiths, Berdoe & Co., to which we have pleasure in drawing attention here, are "Marine paint," for use in the inside and outside of ships, and all submerged metal and wood work, "Brockley Black," ready for use, and more particularly adapted for boilers, engines, and all work exposed to heat, "Anti-Fouling Paint" which contains no mercury to affect the iron, but which is very powerful in protecting iron and wood ships from corrosion and decay, and preventing *fouling*. Lastly, there is a special preparation termed "Funnel Paint" well adapted for the purpose indicated by its name, as it will not, we understand, blister or scale off.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Belle of Devon.—On June 25th there was launched from the shipbuilding-yard of Mr. W. H. Shilston, Coxside, a schooner of about 100 tons register. She was christened by Miss C. Shilston (daughter of the owner) the *Belle of Devon*. The vessel is intended for the Newfoundland trade, and will be under the command of Captain J. Quiller.

Queensferry.—On June 25th there was launched from the shipbuilding yard of Messrs. Robert Thompson & Sons, Southwick, Sunderland, an iron screw steamer, built to the order of the Beta Steamship Company (Limited), Sunderland, of the following dimensions, viz.:—Length, 225 ft.; breadth, 32½ ft.; depth, 16 ft. She has been constructed under Lloyd's special survey to class 90 A 1. The engines, which are of 120 n. h. p. are by Messrs. Black, Hawthorn, & Co., Gateshead. The vessel has two decks of iron, long half poop, and bridge decks, also of iron, topgallant forecastle of wood, and chart-house and companions of iron, and will be fitted with all the latest improvements. The cabin is fitted up aft for the accommodation of captain and officers, the bridge-house amidships for engineers and petty officers, and the forecastle for seamen. She has three steam winches and donkey boiler by Messrs. Welford and Wigham, Pallion, patent midship steering apparatus, and aft screw gear by Messrs. Crawford & Sons, Monkwearmouth; Emerson, Walker, & Co.'s patent windlass, &c., &c. As the vessel left the ways she was christened the *Queensferry* by Miss Rogerson, of Croxdale Hall.

Uppingham.—On June 27th there was launched from the ship yard of Messrs. Raylton Dixon & Co., of Middlesbrough, steamer named the *Uppingham*, built to the order of Messrs. Galbraith, Pembroke & Co., of Austin Friars, London. Her dimensions are :—300 ft. over all, 38 ft. breadth, and 26 ft. 2 in. depth of hold. Her gross tonnage will be about 2,220 tons. She is built on the spar-decked rule, has a main deck of iron, and spar-deck of teak, and has water ballast throughout on the cellular principle. She will be fitted with engines of 200-horse power, nominal, by Messrs. Thomas Richardson & Sons, of Hartlepool, and completed with all the most recent appliances for vessels of the highest class. On leaving the ways she was christened the *Uppingham* by Miss Page, daughter of Captain Page, of London.

Equity.—On June 27th there was launched from the shipbuilding yard of Messrs. D. Baxter & Co., North Sands Point, Sunderland, an iron screw steamer of the following dimensions :—Length, 130 ft.; breadth, 20 ft.; depth of hold, 10 ft. She is of somewhat novel construction, being specially designed for carrying 350 tons deadweight cargo on a mean draught of 2 ft. 10 in. She is classed 100 A 1 at Lloyds, having been built under special survey. The ceremony of naming the vessel was performed by Mrs. Williams. The *Equity* is built to the order of Messrs. Jenkins & Co., of Swansea, and is intended for the Welsh iron ore trade.

Broomhaugh.—On June 27th, was launched an iron screw steamer, built for Messrs. Elliott, Lowrey, and Dunford, Newcastle, by Messrs. C. S. Swan & Hunter, Wallsend, and of the following dimensions :—Length between perpendiculars, 285 ft.; breadth, 36 ft. 3 in.; depth of hold, 24 ft. 6 in.: tonnage, gross, 2,120 tons; nett, 1380 tons. The vessel was named the *Broomhaugh*, by Miss Ethel Lowrey. After the launch the vessel was towed to St. Peters to receive her machinery of 200-horse power, which has been made by Messrs. R. & W. Hawthorn.

Boyne.—On June 29th, Messrs. Wm. Gray & Co. launched from their yard, at West Hartlepool, an iron screw steamer of the following dimensions :—Length, 285 ft. between perpendiculars; breadth, 35ft. 3 in.; depth, 24 ft. 6 in.; class, 100 A 1 at Lloyd's. The vessel is built on the three deck principle to the order of the Mercantile Steam Shipping Company, London, and is intended to carry 2,800 tons dead weight. She is fitted with every recent improvement, including steam steering-gear by Messrs. Halliday, of Sunderland, and patent windlass by Messrs. Emerson & Walker, of London. Her engines are to be fitted by Messrs. Thomas Richardson & Son, of Hartlepool. On leaving the ways the vessel received the name of *Boyne*, and the christening ceremony was performed by Miss Harriet Smith, of Stockton.

Galatia.—On June 29th, Messrs. David and William Henderson & Co. launched from their shipbuilding yard at Meadowside, an iron screw steamer built to the order of the Barrow Steamship Company, of the following dimensions :—Length, 240 ft.; breadth, 37·6; depth, 29·6, with a gross tonnage of 3,150 tons. She will be supplied by the builders with compound engines of 500-horse power. As the vessel left the ways she was named the *Galatia* by Miss Meiklereid, daughter of Captain Meiklereid. The *Galatia* will be fitted with all the latest and most approved appliances, and when completed will form one of the Anchor Line Fleet.

Manna.—On July 11th, Messrs. William Gray & Co. launched from their yard at West Hartlepool, an iron screw steamer of the following dimensions :—Length between perpendiculars, 216 ft.; breadth of beam, 31 ft.; depth of hold, 15 ft. 2 in. Class, 100 A at Lloyds. The vessel whose name is *Manna*, is built to the order of Mr. Henry Martini, of Glasgow, and is expected to carry 1,300 tons deadweight. She is fitted with every modern improvement, including steam steering gear by Messrs. Muir & Caldwell, of Glasgow, and patent steam windlass by Messrs. Napier Brothers, of Glasgow. The engines are to be fitted by Messrs. Blair & Co. (Limited), Stockton.

Hesper.—On July 12th Messrs. Edward Withy & Co., launched from Middleton Shipyard, West Hartlepool, an iron screw steamer of the following dimensions :—Length, b.p., 257 ft. 6 in.; beam extreme, 34 ft. 6 in.; depth moulded, 20 ft. 4½ inches; and dead weight carrying capacity, 2,400 tons. She is built to Lloyd's highest class, and has long quarter deck, bridge-house, and top-gallant forecastle; double bottom all fore and aft, on the cellular principle; four hatches arranged to meet the Board of Trade regulations as feeders for grain cargoes; four steam winches, patent windlass, and all modern improvements. Her decks, chart-house, engine, and cabin skylights, and companions are of iron, and she will be rigged as a topsail schooner. The engines will be supplied by Messrs. Blair & Co., of Stockton-on-Tees. This vessel is No. 99 in the builder's yard, and is the sixth launched by her builders this year. As she left the ways she was christened *Hesper* by the Mayoress of Hartlepool, Mrs. J. Horsley.

Andora.—On July 12th an iron sailing ship was launched from the building-yard of Messrs. Richardson, Duck & Co., South Stockton, of the following dimensions, viz. :—Length over all, 264 ft.; length between perpendiculars, 244 ft.; breadth, extreme, 39 ft.; depth in hold, 24 ft. 3 in.; tonnage, gross, about 1,724 tons; tonnage, nett, about 1,667 tons. She is classed 100 A 1 at Lloyd's, and has been built under special survey. The vessel has a full poop for the accommodation of first-class passengers and Captain and Officers, a top-gallant forecastle for Crew, and a deck-house amidships for the Petty Officers; galley, &c. The ship has been built for Messrs. E. F. & W. Roberts, Liverpool. As the vessel was leaving the ways she was christened the *Andora* by Mrs. Mathias, wife of Captain Mathias, of the Owner's firm.

Brocadalie.—On June 28th there was launched from the building-yard at Jarrow a screw steamer, built to the order of Messrs. Temperley & Co., of Newcastle. She is 303 ft. long, 37 ft. broad, and 36 ft. deep. She has Emerson, Walker & Co.'s patent windlass, and will be classed 100 A 1 at Lloyd's, and is named the *Brocadalie*.

Lesseps.—On July 13th there was launched from the shipyard of Messrs Raylton, Dixon & Co., Middlesbrough, the iron screw steamer *Lesseps*, built to the order of Norwegian owners. Her dimensions are :—270 ft. long by 34 ft. 9 in. breadth of beam, and 24 ft. 3 in. depth of hold. Her gross tonnage will be about 1,825, and she will carry about 2,500 tons deadweight on 22 ft. draught. She is built on the three-decked rule, having main and upper decks laid, the latter being of iron. She has water ballast in the after hold, and in a large chamber in the main hold forward of the engine-room. She will be fitted with engines of 150 horse-power by Messrs. Blair & Co., of Stockton, and completed with all the most recent appliances for vessels of this class. On leaving the ways she was christened the *Lesseps* by Mrs. Belk, of Middlesbrough.

Llangollen.—On July 13th a screw steamer of about 2,400 tons burthen was launched at Wallsend from the yard of Messrs. Schlesinger, Davis, & Co. This vessel, named the *Llangollen*, has been built to the order of Mr. Charles E. Stallybrass, of Cardiff, and classes 20 years in the Liverpool Underwriters' Registry. Her measurements are :—260 ft. between perpendiculars, 36 ft. beam, and 19 ft. depth of hold. Powerful steam winches are placed at each of the principal hatchways for loading and discharging cargo. Harfield's steam windlass is fitted; water ballast, and every other necessary requirement for speedy moving and working of the vessel have been provided. The cabins for the captain, and a few spare berths are under the full poop aft, and the engineers' accommodation is under the fore part of the bridge. Engines of 160 nominal horse-power will be supplied by Messrs. Black, Hawthorn & Co., Gateshead. The engines are inverted direct-acting compound surface-condensing, and have cylinders 36 in. and 68 in. diameter, and 36 stroke; 80 lbs. working pressure of boiler. As the vessel left the ways she was named by Miss Edith Gertrude Stallybrass.

Tempo.—On July 14th a screw steamer named the *Tempo* was launched from the yard of Messrs. T. & Wm. Smith, at North Shields. She is intended for the coasting coal trade and the Baltic, and has been built to the order of Messrs. Fenwick & Reay, of London. She is 230 ft. long, by 35 ft., and in depth 17 ft. Her engines are built by Messrs. Hawks, Crawshaw, & Son, Gateshead, and are of 140-horse power. She is schooner-rigged and fitted up with Donkin & Nichol's steering apparatus, and with water ballast arrangements. She will be commanded by Captain Craig.

Thalatta.—On July 13th, there was launched from the shipbuilding and engineering works of Messrs. W. H. Potter & Son, Queen's Dock, Liverpool, an iron sailing ship of the following dimensions :—Length, 280 ft.; beam, 39 ft.; depth in hold, 24 ft.; tonnage, b.m., 2,000 tons, and ditto register, 1,800 tons. The vessel was christened the *Thalatta*, by Mrs. M. M'Diarmid. The *Thalatta* has been built for Messrs. M'Diarmid and Greenshields, of Liverpool. She will class 100 A at Lloyd's and 20 years in Red in the Liverpool Underwriters' books, but her scantling is considerably in excess of the requirements of both books.

Portugal.—On July 16th, Earle's Shipbuilding and Engineering Company (Limited), Hull, launched a steamer for Portuguese Owners. The vessel was named the *Portugal* by Mrs. Bromage, of London. The *Portugal*, which is intended to convey the mails and passengers between Lisbon and the Portuguese settlements on the West Coast of Africa, has been built for the Empress Nacional of Lisbon. She is a spar-decked ship of about 2,000 tons gross register, built to class 100 A 1 Lloyd's, and is 290 ft. long between perpendiculars, 35 ft. beam, and 25 ft. 6 in. deep.

She is brig-rigged, and has accommodation in the 'tween decks aft for 60 first-class passengers, and amidships for 30 second-class. There is also accommodation in the 'tween decks for third-class passengers. Arrangements are made for carrying 400 tons of water ballast. She will be propelled by a compound surface-condensing engine of 220 nominal horse-power, having cylinders 40 in. and 72 in. diameter and 45 in. stroke, and supplied with steam of 80 lbs. pressure from two large single-ended boilers, placed with their backs to the engines. On the spar-deck is a large donkey boiler, which supplies steam to powerful winches and cranes.

Palm Branch.—On July 16th there was launched the first of two steamers being built by Messrs. Bartram, Haswell & Co., South Dock, Sunderland, to the order of the Nautilus Steam Shipping Company, of whom Messrs. F. and W. Ritson are directors and managers. The dimensions of the new vessel are as follows:—Length between perpendiculars, 260 ft.; breadth, extreme, 36 ft.; depth to the top of floor, 18 ft. 6 in. She is classed 100 A 1 at Lloyd's. Her dead weight carrying capacity is 2,200 tons. She is constructed with iron decks, except full poop, four large steam winches with boiler of extra large size, to work to 80 lb. pressure, and is specially designed and fitted to carry grain cargoes in bulk. Her engines are supplied by Messrs. Dickinson, of Monkwearmouth. She has two boilers multitubular form, each 13 ft. mean diameter and 10 ft. 6 in. in length, heating surface 3,200 sq. ft., and working pressure 80 lbs. As the vessel left the ways the christening was performed by Miss Bella Ritson, who named her the *Palm Branch.*

Navarre.—On July 16th the Barrow Shipbuilding Company launched from their yard a steamer named *Navarre*, built for the Société Générale Transport Maritime, Marseilles. The vessel is 4,000 tons burthen, being 400 ft. long, 40 ft. broad, and 32 ft. 6 in. depth of hold, with 2,500 indicated horse-power. She is intended, along with a sister boat building in the same yard, to trade between Marseilles and the Brazils.

Ashdene.—On July 16th Messrs. Osbourne, Graham & Co., of Hylton, launched from their shipbuilding yard an iron screw steamer, to the order of Messrs. Bulman & Dixon, of Sunderland, of the following dimensions, &c.:—Length, 230 ft. by 33 ft. beam, and 16 ft. 3 in. deep, with raised quarter deck, bridge-house, and topgallant forecastle, and with compound engines by Mr. George Clarke, with cylinders 28 in. and 53 in. by 36 in. stroke. She has been fitted with large hatches and three powerful steam winches, and all appliances for rapid loading and discharging, patent windlass, Davis' steering gear amidships and Hasties' aft. On leaving the ways she was named the *Ashdene* by Mrs. John Dixon.

Ross.—On June 28th, a vessel named the *Ross*, built at Howdon to the order of Messrs. John Cory & Son, of Cardiff, was launched. She is 240 ft. long, 33 ft. broad, and 18 ft. deep. She is fitted with patent brass cone windlass by Emerson Walker & Co., and has been built to take the highest class at Lloyd's, and is the 12th vessel built by Palmer & Co. for the same owners.

LAUNCHES.—Scotch.

Tower Hill.—On June 28th, at Dobie & Co.'s yard, Govan, a further addition to the Liverpool steam fleet was safely put into the water. The *Tower Hill* is a sister ship to the Notting Hill, which has excited some interest lately owing to her novel arrangements, and which has just sailed for Calcutta. Like her, the *Tower Hill* is of steel, and provided with two propellers at the stern instead of the usual single screw. Her dimensions are 420 ft. long by 45 ft. beam, with a carrying capacity of over 5,000 tons deadweight upon a light draught of water. Her engines and boilers are by Messrs. Jas. Howden & Co., Glasgow, and they are to indicate upwards of 3,000-h.p., and to propel the steamer between 13 and 14 knots loaded. The same builders have a third steamer, the *Ludgate Hill*, of still larger dimensions, rapidly approaching completion, also on account of Mr. W. H. Nott and Mr. W. Becket Hill, the owners of the new line.

Thistle.—On June 28th, Messrs. Blackwood and Gordon launched at Port Glasgow, a screw steam-yacht, called the *Thistle*, for the Duke of Hamilton. Its dimensions are:—Length over all, 203 ft.; length over tonnage, 180; breadth of beam, 25 ft.; depth of hold, 14 ft.; of 600 tons, and of the highest class at Lloyd's. The *Thistle* is schooner rigged with clipper stem and round stern. She is supplied with four boats and a steam launch, the windlass is driven by steam, and there are mounted on deck a couple of brass four-pounder guns. The builders supply a pair of compound inverted surface-condensing engines of the highest make and finish, capable of indicating no less than 600-horse power. Cylinders, 26 in. and 52 in., with a stroke of 2 ft. 9 in. It is expected that at least 14 knots will be got out of the new vessel. The boiler is 12 ft. in diameter and 14 ft. long, with four furnaces to be fired from both ends. Iron bunks run alongside the engines and below the cabin capable of holding 160 tons of coal. Mr. Cornelius Young, of Cowes, Isle of Wight, will command her. As the new yacht left the ways she was named by the lady of Mr. Auldjo Jamieson, Edinburgh, chamberlain to the Duke of Hamilton.

Ro omahana.—On June 28th Messrs. Russell & Co., Cartsdyke, launched a sailing ship of 1,624 tons, which has been built to the order of Mr. J. R. de Wolff, of Liverpool, for the East Indian trade, and is fitted with patent capstan windlass, Emerson Walker & Co.'s patent. Her dimensions are:—Length, 248 ft.; breadth, 38 ft.; depth, 22 ft. 9 in.

Austerlitz.—On June 29th there was launched from the building-yard of Messrs. Hall, Russell & Co., Aberdeen, an iron screw steamer named *Austerlitz*, of the following dimensions:—Length, 265 ft.; breadth, 35 ft. 6 in.; depth, 19 ft. 6 in., and 1,700 tons. This vessel has been built under special survey, taking the highest class in both Lloyd's and Liverpool Registrys, and will be fitted with compound surface condensing engines of 170-horse power nominal, water ballast, patent windlass and capstan, steam winches, steam steering gear, and all the most approved appliances for facilitating the loading and discharging of cargoes. She has been built to the order of Messrs. Allan C. Gow & Co., Glasgow, and is specially fitted for the China and Atlantic trades. As the vessel left the ways she was named *Austerlitz* by Mrs. Clements, and was afterwards towed to the sheer poles, for the purpose of receiving masts and machinery.

Liimfjorden.—On June 29th there was launched from the building-yard of Messrs. Lobnitz & Co., Renfrew, a screw steamer of the following dimensions:—165 ft. by 24 ft. by 17 ft. The vessel is built of steel, and classed in Verita's highest class, and will be fitted with the builders' compound engines of 85-horse power nominal. As she left the ways she was named *Liimifjorden* by Miss Annie Lobnitz. Immediately after the launch she was taken into the builders' tidal dock, where she will receive her boilers and machinery. The *Liimfjorden* has been built to the order of the United Steamship Company, of Copenhagen, for their Baltic trade. Captain Petersen is to command the vessel.

Spartan.—On July 12th the *Spartan* (s), built by Messrs. James & George Thompson, of Clyde-bank, for the Union Steamship Company, was launched. She is the 38th vessel which that company has built or purchased for their mail service with the South African Colonies since they commenced the service in 1857. The *Spartan* is the largest vessel which has yet been placed on the Cape of Good Hope service, her dimensions being:—Length between perpendiculars, 365 ft.; beam, 43 ft.; depth, 32·6 ft.; and her gross registered tonnage is estimated to be about 3,750. The ship is fitted with every modern appliance, and will carry 150 first-class passengers, 50 second, and 100 third. Her engines are 3,400 horse-power. She is fitted with 11 water-tight bulkheads, and is heated throughout by steam.

Claymore.—On July 14th Messrs. J. & G. Thomson launched from their yard at Clyde Bank a screw steamer built to the order of Mr. David M'Brayne, 119, Hope-street, as a consort to the *Clansman* and *Clydesdale*, so long known in the Stornoway trade. The ceremony of naming her the *Claymore* was performed by Miss Annie Thomson, of Mountblow. She has a complete awning deck similar to *Clansman* (s), her dimensions being:—Length, 225 ft.; beam, 29½ ft.; depth, 15 ft.; and from her fine lines is expected to sail very fast. She will be supplied with compound engines by her builders, and is fitted with every improvement for comfort of passengers and working of cargo.

Alaska.—On July 15th the *Alaska* was at last successfully launched from the shipbuilding yard of Messrs. Elder & Co., Fairfield. The *Alaska* was to have been launched on the previous Wednesday, and the vessel at first glided smoothly down the ways, after the ceremony of naming her had been performed. About halfway, however she stopped, and remained fast, and all efforts to get her into the water were unavailing. The *Alaska* has been built for the Guion line, and it is of large proportions. Her length is 520 ft., and she has five decks, on the fourth of which alone accommodation can be provided for 1000 passengers. Her tonnage is 8000, and her indicated horse-power 10,500. After being launched, the *Alaska* was taken to Messrs. Elder's private dock, where she will be fitted with engines, &c. She lies beside the Russian war-ship, *Peter the Great*, in comparison with which she is of huge dimensions.

Savona.—On June 28th Messrs. Steele & Co., Greenock, launched from their shipbuilding yard a steamer, built to the order of Messrs. James Currie & Co., of Leith, for the Leith, Hull, and Hamburg Steampacket Company. The vessel is constructed of steel, and is

250 ft. long, 33 ft. broad, and 17 ft. 3in. in depth, with compound surface-condensing engines of 120 horse power nominal. Her gross tonnage is 1084 tons. She is similar in every respect to the *Modena*, launched by Messrs. Steele & Co. for the same owners about six weeks ago.

Rosa Beilo.—On July 1, there was launched at Granton this steam yacht. She has been built by Messrs. D. Allan, builders, Granton, to the order of Messrs. Wm. Gunn & Co., Granton. She is 45 ft. in length, 8 ft. 6 in. in breadth, and her hold 5 ft. 10 in. in depth.

Ville de Naples.—On July 12th Messrs. A & J. Inglis launched from their shipbuilding-yard, at Pointhouse, a screw steamer, of 1.900 tons, for the Mediterranean mail and passenger service of the Compagnie Générale Transatlantique. This steamer is a sister ship of the *Ville de Rome*, built by the same firm. The principle dimensions are:—Length, 314 ft.; breadth, 34 ft. 3 in.; depth, 25 ft. 6 in. Immediately after the launch the vessel was berthed under the sheer-legs at the builder's wharf, where they at once commenced fitting the engines, of 2,400-horse power, on board. The ceremony of naming the vessel *Ville de Naples* was performing by M. Bocaudé.

TRIAL TRIPS.

White Sea (s).—On June 24th, the Dundee, Perth, and London Shipping Company's steamer, *White Sea*, built by Messrs. Alexander Stephens & Sons, went her trial trip. The steamer took her departure from the roads opposite Camperdown dock about 11 o'clock. There was a stiff breeze from the south-west, but the weather was bright and genial, and the sea smooth. After proceeding within sight of the Island of May and the Bass Rock, the vessel was put about for Dundee. In the course of the run the speed of the vessel was tested, and it was found that she steamed at the rate of 11½ knots. The engines worked very smoothly.

Puertoriqueno.—The new steamship *Puertoriqueno* built for the line of Spanish steamers managed by Messrs. White, Forman, & Co., of this city, intended for trading between Liverpool and Porto Rico, was taken out on her trial trip on June 29th. Amongst those on board were Messrs. Forman, Charwarri, of San Juan; Vidol, of Ponce; Casson & Edwards, of Manchester; Horn, Davidson, M'Kaig, and Glass, of Liverpool; W. Jones, of Seaforth, &c. The vessel left the Prince's Landing-stage a few minutes after ten a.m., and proceeded down the river under easy steam until she passed the bar, and then headed towards the Welsh coast, passing near Llandudno Bay, when she was again turned towards Liverpool, cruising about in various directions until seven o'clock in the evening, when she was put into the Wellington Dock In the course of the trip she proved herself to be a steady. and pleasant steamer, having only a very small degree of vibration. The *Puertoriqueno*, which is about 2200 tons gross measurement. is 280 ft. in length, by 35 ft. 8 in. in breadth, 24 ft. 7 in. in depth, is of iron, and was built by Messrs. R. & J. Evans, of, Liverpool. She is fitted with compound engines, with cylinders of 33 and 66 in. in diameter, with a stroke of 42 in., with one steel boiler, having six furnaces, and working at a pressure of 80lbs. to the square inch. She will carry 3,000 tons dead weight. Her engines which are of very fine construction, were made by Messrs. David Rollo & Sons, of this city. At 68 revolutions per minute, the vessel made eleven knots per hour. The *Puertoriqueno* has four steam winches, supplied by Messrs. Taylor & Co., and has steam steering gear, made on Harrison's principle, by the Patent Steering Engine Company. The ship and engines were designed by Mr. G. Goodwin, of this city, under whose superintendence the construction of the whole was carried out. The day's proceedings gave great satisfaction to all on board.

The Anjer Head.—On July 1st there arrived in Cardiff, on the completion of her trial trip from the Tees, the *Anger Head*, which has been completed by Messrs. Raylton Dixon & Co., of Middlesbrough, to the order of Messrs. Angier Brothers, of Bishopsgate-street, London, being the second vessel of her size which has been built for this firm by the above-named builders. She is a boat of 286 ft. over all, by 36 ft. beam, and 24 ft. 6 in. depth of hold, having a gross tonnage of 2,015 tons, and carrying capacity of 2,900 or 3,500 tons measurement. She is built in excess of Lloyd's highest class. Has iron main deck, and upper deck of pitch pine, water ballast in fore and main holds and under boilers. Her engines, which are by Messrs. Thomas Richardson & Sons, of Hartlepool, have given most satisfactory results, as the vessel made the run to Cardiff from the Tees in 62 hours, an average of nearly 12 knots per hour.

Peking.—On July 2nd, the *Peking*, a screw steamer, built by Messrs. Wigham Richardson & Co., for Messrs. Wm. Milburn & Co.'s China Line, started for its trial trip from the mouth of the Tyne. The *Peking* is similar to the *Cha Keiang*, *Yangtse*, *Amoy*, *Ningpo*, *China*, and other vessels of this line. It is 275 ft. from stem to stern, 33 ft. beam, and 23 ft. depth of hold. The engines, which are the builders' own make, are 200-horse power, indicating 700-horse power, and the speed obtained during the trip was over 13 knots. She is fitted with Emerson Walker's patent direct steam windlass, and is built to accommodate 36 first-class cabin passengers, and 400 Chinese between decks.

Corsican.—The new screw-steamer *Corsican*, built to the order of Messrs. C. & J. Macfarlane, Oswald-street, Glasgow, specially for the Mediterranean fruit trade, by Messrs. Murdoch & Murray, Port Glasgow, went down the Firth of Clyde on her trial trip on July 2nd last. She is a steamer of 1,200 tons, built to highest class in Lloyd's, and the machinery by Messrs. William King & Co., Dock Engine Works, Glasgow, is on the compound surface-condensing principle, the cylinders being 28 and 50 diameter by 36 stroke, fitted with expansion gear and all the latest improvements, steam winches for working cargo, &c. The speed on the measured mile was 12 knots, which was considered very satisfactory.

Arica.—The Pacific Steam Navigation Company's new screw steamer *Arica*, just completed by Messrs. Laird Brothers, Birkenhead, made her official trial trip in Liverpool Bay on July 5th. No runs were made on the measured mile, but between the Bar Light and Orme's Head the vessel maintained a speed of upwards of 12 knots, the engines indicating about 1.300-h.p. She had upwards of 1,000 tons weight on board at the time, and the results obtained were considered eminently satisfactory. The *Arica* is intended for the company's West Coast trade. She is built of Siemen's-Martin steel, and is of the following dimensions:—Length, 300 ft.; beam, 36 ft.; depth to maindeck, 19 ft. 6 in.; tonnage, 1.920 b.m. Ballast tanks are fitted to contain about 300 tons water, which is pumped out in a remarkable short space of time by a No. 8 Pulsometer pump. Like the majority of the Company's coast steamers she is constructed with an awning deck, and in houses on that deck is provided accommodation for a moderate number of passengers as also for captain and officers, but she has been designed principally for cargo and cattle traffic. The engines of Messrs. Laird's construction work at 90 lbs. pressure, and the boilers are of steel.

Fieramosca.—The *Fieramosca* (s), of Sorrento, Castellamare. ran her official trip on the Clyde on July 6th attaining a speed of 13½ knots, which is specially noteworthy, as she is only 133 ft. long over all, and built of scantling heavy enough to enable her to get Lloyd's 90 A 1 class. Captain Antonio Cocurullo is the owner. She is intended to carry up to 250 passengers on day trips in the Bay of Naples, and as seats all round on deck, with galvanised stanchions, and awnings, saloon, and cabins, smoking saloon on deck aft, and second class saloon below forward. She was built and engined by Messrs. Hanna, Donald & Wilson, of Paisley, and has steam windlass, separate ventilating engine for stokehole, &c., &c.

Craigallion.—On July 12th the *Craigallion* (s), 1,250 tons recently launched from the shipbuilding-yard of Messrs. Ramage & Ferguson, Leith, went down the Firth of Forth to have a preliminary trial of the engines. This steamer has been engined by Messrs. Muir & Houston, Harbour Engine Works, Glasgow, and the results obtained were of the most satisfactory description. The diameter of the cylinders is 26 in. and 50 in. by 33 in. stroke, and on a mean trial the steamer obtained a speed of 11½ knots, a result which exceeded the engineer's and builders' expectations. This steamer carries Emerson Walker & Co's. patent windlass and is owned by Messrs, Walker, Donald & Co., 13, Dixon Street, Glasgow, and is intended for the Spanish fruit and mineral trades. The *Craigallion* leaves in a day or two for Bilbao.

Chateau Lafite.—The screw steamer *Chateau Lafite*, 366·25 by 41·1 by 30·00, 3,462 tons gross, and 450-horse power, with cylinders 45 by 82 by 50 stroke, built by Messrs. Oswald, Mordaunt, & Co., Shipbuilders and engineers, Southampton, for the Compagnie Bordelaise de Navigation à Vapeur, Bordeaux, went for her official trial of six hours run round the Isle of Wight, on the 14 July, when, with a displacement of 4,400 tons, she averaged a mean speed of 12½ knots, with a strong tide against her for the greater part of the way. On the 21st she went her second trial for speed on the measured mile, with 1,600 tons on board, when she averaged a speed of 13·6975 knots; one run being 14·062 and the other 13·333. Her engines indicated 2,687-horse power. Everything working cool and satisfactorily. She left immediately after direct for Bordeaux. She is the pioneer of the new company's fleet, which is intended for service between Bordeaux and New York.

Constance.—On July 8th, the new unarmoured steel and iron corvette, *Constance*, 14 guns, recently launched at Chatham Dockyard, made her six hours' official trial at sea. The trial was of a very satisfactory character, the average speed being 14 knots per hour. The contract power of the engines was 2,300, but they worked up to 2,597. The revolutions were 110 per minute. There was not the least sign of hot bearings. The makers of the engines are Messrs. Penn & Sons.

Ville de Rome.—The official trial trips of this steamer took place on July 7th, and under the superintendence of Mr. Jules Montargis, representing the Compagnie Générale Transatlantique. She is the third of four similar steamers ordered by this company from Messrs. A. & J. Inglis, Pointhouse, and forms an addition to their Mediterranean fleet, which, though of very recent creation, now numbers about thirty vessels. The first eight of these vessels were built on the Clyde last year, and attracted some attention on accout of the smartness with which they were turned out of the Clyde yards. One of these eight, the two built by Messrs. Inglis, viz., the *Charles-Quint* and *Ville de Madrid*, have left the others far behind in speed and economy of fuel; and from the observations on the *Ville de Rome's* trial, she is not likely to fall short of the sister vessels.

Maurice Reunion.—On July 20th the *Maurice Reunion*, built by Messrs. Wm. Hamilton & Co., of Port Glasgow, for Messrs. Gravier & Co., Marseilles, had her trial at the measured mile, along Sea Reach, near Southend. This vessel, which has been constructed for the Mauritius trade, is 299 ft. over all, 36 ft. beam, and depth, moulded, 25 ft. 6 in. She is built on three deck rule, two being laid of iron, and has a long bridge amidships, under which is a saloon and accommodation for her officers and engineers. She has engines by Dunsmuir & Jackson. The following result was obtained on her trial, 10·50 knots with 70 lbs. of steam, and it was considered very satisfactory. A trial was made to ascertain the consumption of fuel, and the result showed a rate of about 13½ tons per 24 hours. The machinery during the trial worked with perfect smoothness, and the trial gave great satisfaction to all interested.

Armathwaite.—On July 19th a large number of engineers and shipowners assembled to witness the trial trip of a fine new cargo steamer, the *Armathwaite*, which has been built to the order of Mr. William Burnyeat, jun., of Whitehaven, by the Whitehaven Shipbuilding Company, Limited, made a trial trip from the Mersey. The vessel had been brought round to the river in June last to be fitted with her engines and machinery. The *Armathwaite* is intended for the general carrying trade, her capacity being about 2,300 tons. Dimensions:—265 ft. over all, breadth 34 ft., and depth 20 ft. 9 in. She is classed A 100 at Lloyd's, and has been built with a double bottom for water ballast. She has a full poop, deck-house amidships, topgallant-forecastle, and iron upper deck. The fittings are of the most modern description, and include Emerson & Walker's patent windlass, Taylor's steam winches, and Clarke's steam steering gear. Her engines, which are 160 nominal horse-power, have also been fitted by Messrs. Jones & Sons, and the working of the machinery gave every satisfaction to those on board. The greatest interest centred in the successful working of Turton's crank and Turner's boilers. The recommendation of the former is that it has the web cut in two so that the fibre of the metal possesses a greater strength, and the crank pins are not likely to score. The Turner boiler reduces the weight of the boiler to about one-half that of the old style, as well as reducing the cubical space occupied, and a consequent reduction in the quantity of fuel required to heat it. We shall in an early impression illustrate these boilers and the crank shaft. It must now suffice to say that the trip was in all respects a success. The engines gave no trouble whatever, although they had never been under steam before, save for a few hours at the dock side. They indicated 630-horse power with a pressure of 70 lb., and 67 revolutions. The boilers are intended to carry 80 lb, but they were fired very easily, as it was not deemed necessary to push the engines in any way. Mr. Turner's boiler is of the locomotive type, with a fire brick furnace instead of one with water legs. Although very little is known about this boiler outside of Liverpool circles, it has been gradually gaining in favour since it was patented in 1878. The number of boilers made and being made is now forty-five. The first of these boilers was made for the screw cargo launch *Bagieda*, built at the Canada Works, Birkenhead, to the order of Messrs. Herschell, African merchants, and under the superintendence of Messrs. Ashlin & Asbridge, consulting engineers of Liverpool. The vessel is 81 ft. long on the water line, 9 ft. 6 in. beam, 5 ft. deep moulded, and 3 ft. 2 in. draught of water loaded, the guaranteed speed being ten knots per hour. The engines are on the high-pressure non-condensing principle and of 13½ nominal horse-power, and are supplied with steam of 80 lb. pressure per square inch from a Turner's patent boiler, having 2172 square feet of heating surface, and a grate with 10½ square feet area. This vessel has now been constantly at work on the river Volta for more than two years with very satisfactory results, having steamed the distance of 90 miles in a little less than six hours, no current or tide at the time. The owners are now on the point of ordering a second vessel of larger size than the *Bagieda*, the machinery, and especially the boiler, to be on the same design. The second vessel fitted with these patent boilers was the twin screw tug and tender steamer *Gamecock*, built at the Canada Works to the order of Mr. Beckett Hill. This vessel is 155 ft. long by 25 ft. beam, and is fitted with two pairs of compound surface condensing engines of 180 nominal horse-power, which indicated on trial 1164-horse power. This vessel has now been above sixteen months at work, giving very satisfactory results upon a very small consumption of coal. The yacht *Mizpah* is now under steam on her second yachting season, since she has been fitted with a pair of compound surface condensing engines, and a Turner's patent boiler of 12 nominal horse-power, the working steam pressure being 110 lb. per square inch. The engines indicated 75-horse power on the trial trip. The *Nottinghill*, now on her voyage to Calcutta, is fitted with ten boilers, which are calculated to bear a working steam pressure of 125 lb. per square inch. The engines are of 570 nominal horse-power, and are to indicate above 3000-horse power. Two other and similar vessels are now being built for the same company. The tug steamer *Storm King* is fitted with two patent boilers. The engines are on the low pressure jet condensing principle, the boilers have been above six months at work, the results being very satisfactory, and the consumption of coal is said to be very much less than with the former boilers.

De Bay.—No doubt it will interest many engineers and shipowners to know that a series of close, crucial, comparative, and in every way trustworthy trials of the relative merits of the "patent De Bay" propeller and the ordinary screw is being carried out under the supervision of engineers appointed by the De Bay Patent Direct-acting Propeller Company. Messrs. Capper, Alexander, & Co. have recently added to their fleet a new vessel, which has been named the *De Bay*, and it is their desire, having carefully gone into the matter, to have this vessel fitted with a propeller, or rather pair of propellers, on the *De Bay* principle. The *De Bay* is a first-class cargo steamer, and reflects great credit on her builders, Messrs. Palmer & Co., of the Jarrow Shipbuilding and Engineering Works. She is an exceptionally strongly built, commodious, highly-finished cargo steamer. Her length is 250 ft.; beam, 35 ft. 4 in.; depth of hold, 23 ft.; and with a mean draught of 21 ft. she will carry some 2500 tons of cargo. Her engines are compound surface condensing, with cylinders of 30 in. and 55 in. diameter, respectively, having a stroke of 42 in., and are capable of indicating upwards of 900-horse-power; they are fitted with all the latest improvements in engineering, and in every part indicate the care they have received at the hands of Mr. Gibb, of the Jarrow Works, under whose direction they have been constructed. In the engine-room is to be found Durham's patent marine governor on a new pattern, in which he has abandoned the gearing to which some shipowners had objected. In this his latest design the water cylinder revolves, and its position on the main shaft or spindle—at right angles to its position in the original design—obviates of course the necessity for gearing to drive the internal fans. On deck the steel hawsers, on neat rollers, fore and aft, attract notice, and are for mooring a ship, a vast improvement upon the untidy, uncouth, and unwieldy cables, which for too long a time have retained their places on the decks of our steamers. The wheel-house is fitted with a steam steering gear, from the patented design of Mr. Nelson, and is worked from the upper bridge by means of a very small wheel. Should an accident occur to the little engine which works the steam steering apparatus, a lever may instantly through the apparatus into gear for steering by hand, for which purpose a large hand wheel is attached to the machine. We have said that Messrs. Capper, Alexander, & Co., had determined to have this ship fitted with the De Bay propeller, but in order that an absolute comparison might be made as to its behaviour, it was arranged that a common propeller should first be fitted to the ship, that trials under certain known conditions should be made, and that the *De Bay* should make her first voyage with it. At the conclusion of the first voyage the De Bay propeller will be attached, and trials will then be run under exactly similar conditions. On the 30th of June the first of the series of trials was made in the presence of several shipowners and engineers. On this occasion the steamship was unladen, having only water ballast on board. Several runs were made over the measured mile a little to the north of the river Tyne, runs at "full speed," "half speed," and "slow," the best speed obtained being at the rate of 10·97, or in round numbers 11 knots per hour. At the luncheon, after the "Success of the steamship *De Bay*" had been proposed by Mr. Gibb, duly honoured and responded to, Mr. Capper in felicitous terms proposed "Success to the De Bay Propeller," which toast was acknowledged by Mr. De Bay, who expressed himself confident that good as was the performance of that day, he would beat it very considerably under the same conditions, when the time came for trial with his propeller. On the 11th of July the second of the series of trials was carried out, the ship having then on board a cargo upwards of 2400 tons. Several runs were made over the mile at the same engine speeds as at the first trial. The highest average of the full speed runs was 9·50 knots, as nearly as may be and this may be regarded as an excellent result. At the conclusion of the trials the *De Bay* sailed for Cronstadt, from whence she returns to London, where she may be expected in a month. The De Bay propeller will then be fitted, and trials will again be carried out, when all the figures resulting from the trials will be made public. That Mr. De. Bay has an excellent performance to beat there is no doubt, but both he himself and Mr. Folkard, who is consulting engineer to the company, are confident of establishing the superiority of the De Bay propeller in point of economy of power with increased speed.

Correspondence.

[It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.—ED.]

"STATUS" OF H.M. NAVAL ENGINEERS.

To the Editor of the MARINE ENGINEER.

SIR,—In our last April number I see you quote a portion of an article from the *Engineer* concerning the "Status" of H.M. Naval Engineers. I am sorry that any of your readers should have allowed it to pass by without comment. May be, some engineer has answered the challenge in the columns of the above-named scientific paper, if not the sooner they do so the better, for that portion of the B. P. who know nothing of a "steamer" will readily believe that the duties of a marine engineer can be carried out effeciently by a locomotive driver. For the benefit of B. P. and the gentlemen who may probably again discuss this question in the next session of Parliament, I will quote an extract from the *Morning Advertiser* of January, 1877. Speaking of the kind and multifarious duties of the engineers on board H.M's. ships, the writer says, "It will rest entirely with him (*i.e.* the engineer) to inspect and surpervise the working of the big guns." Again, of the "Torpedo" which receives its motive power from the compressed air stored within it, which is forced into the interior of the machine with the aid of powerful air-pumps in the hold of the ship, he asks, "Who then is to take charge of these air-pumps and look to the filling of the torpedoes? The engineer has this duty to discharge, for the simple reason that it has to do with *mechanics*, and naturally falls within his sphere. As regards his minor duties connected with the opening and shutting of the bulkheads, and his responsibilities relating to fittings of all kinds, we say nothing; neither need we point out that in the case of mastless ships (iron clads) like the *Thunderer*, the burden of moving the ship, which rests entirely on his shoulders, is a most heavy and responsible one. Indeed it may well be asked, if the engineer has all this to do, what on earth do the other officers find to fill up their time with?"

I will quote again from another and more recent authority. On page 78, in the *Shipowner's and Engineer's Guide to the Marine Engine*, the editor of the *Engineer* will find the following, "A mere hammer and chisel man will ere long be a creature of the past; the advancement of the age demands something more from the sons of steam, and it behoves them during their apprenticeship to master the laws of heat and the principles of mechanism."

The idea of doing away with the present system, and to have *one clever man* to manage the whole of the duties, assisted only by "hammer and chisel" men, must be absurd to any one having the faintest knowledge of engineering. Equally absurd is it to find a parallel between the marine engineer and the locomotive driver. The former is compelled by the Admiralty and the Board of Trade, to appear before them and to satisfy them, that their terms of apprenticeship have been completed, and that their knowledge of mechanics is sufficient to make good any repairs and defects which may be required to be done at some foreign port, and without the aid of a factory. The mere "driver," takes, as it were, his engine from one shop to another in a few hours' run. There is not sufficient time for any serious "wear and tear," before his engine is again in the shop and overhauled. The only parallel between the two duties, as far as I can see, is in the amount of presence of mind required in times of accident, for which quality there is no test, nor can there be, for it is a natural gift, and cannot be acquired by any kind of "coaching." With regard to the great amount of responsibility of the "driver," this applies equally to the "signal man," then according to our friend's argument, the latter should be paid as high a salary as the "engine driver" or "engineer!" Then again, this argument might be taken home to himself, or to a "bishop" or a "lawyer." Supposing the Archbishop of Canterbury neglects his duty, is there a life lost, or a thousand pounds worth of property destroyed? No! of course not. Then why should he have such immense remuneration? Men are remunerated in proportion to the cost and time of their education, and not according to the immediate responsibility of their "callings." No doubt, sir, you may throw more light on this subject, and be able to tell the "public" that the marine engineers are not adequately paid, neither have they the "status" they are entitled to, either in the navy or the mercantile marine, but the day is coming when their true positions must be acknowledged, and their pay and privileges made equal to a clerk's at least.

I am, sir,
Your obedient servant,
"A WOULD BE RULER OF THE QUEEN'S NAVEE."
July, 1881.

STEAM YACHT COMPETITION.

To the Editor of the MARINE ENGINEER.

SIR,—In *The Field* (May 21 and 28) Mr. Dixon Kemp has furnished communications on the subject of steam yacht competition, and justly refers to the great and increasing interest that exists in the performances of this character of vessel. In view of the total absence of any recognized standard of comparison of powers and the manifest necessity of one Mr. Kemp very properly assumes as follows:—That their competitive performance is confined to their hulls and machinery, or, in other words, to their model and power, the value of the former being the least resistance for like displacement; and of the latter, greatest effect with least consumption of fuel.

In order, however, to arrive at these results, he proposes for the comparison of hulls to attain their displacements by a formulated computation of displacement of uniform application for all designs and proportions of hull, and for the comparison of power he holds, it would be preferable to note that indicated by a performance of the engine at an assigned time under the observance of an engineer appointed for the purpose. Yet in order to meet evasions on the part of the engine drivers, who would essay to develop the least power commensurate with the capacity of the yacht, he prefers and submits a general rule, simple in application and which he considers to be sufficiently accurate for the purpose. This rule is based upon the assumption that cylinder and fire grate only are the elements of comparison, as water and coal consumption can be taken as identical, and to attain these elements he proposes to arrive at the mean indicated power (IHP) by the following formula:—

$$\frac{d^2 \div 4 + 10A}{2} = \text{I H P}$$

d representing diameter of cylinder in inches, and A area of grate in square feet. And, in connection with this, he deduces a coefficient of performance by the adopted formula of

$$\frac{S^3 D^{\frac{2}{3}}}{\text{I H P}} = \text{coefficient.}$$

D, representing displacement in tons, and gives 215 as a mean, obtained by results of various trials; and in order to compute the speed when the other elements are known he gives

$$\sqrt[3]{\frac{\text{I H P} \times c}{D^{\frac{2}{3}}}} = \text{speed in knots per hour.}$$

In view of a general coefficient being inapplicable to the varied ranges of displacement he proposes to meet this difficulty by dividing the yachts into a great number of classes, and in the case of extreme ranges of tonnages, instead of deducing a coefficient for $D^{\frac{2}{3}}$ he proposes $\sqrt[3]{D^{\frac{2}{3}}}$, or to correct $D^{\frac{2}{3}}$ by an equation varying as the sixth root of displacement.

In support of these views a Table of the actual I H P, and as computed by his rule, is given. An examination of these, however, shows that their differences range from 1.2 to 32 per cent.

The propriety of the position taken by Mr. Kemp as to the basis of comparison of steam yachts is not to be questioned: it is patent to consideration; but of the justness of his methods of arriving at both of these elements I differ with him widely, and in support of my views I submit the following:—

His method of obtaining the displacement is without regard to the particular outlines and dimensions of each case, except so far as the registered tonnage of the entire hull is assumed to include such peculiarities as may intervene in its six divisions of length and five of depth, and from which its volume is computed.

All vessels are constructed from dimensions arrived at by their lines and sections being extended to full dimensions upon a moulding floor, and from thence they can be taken by reduced dimensions and transferred to paper, from which not only the displacement of the hull can be computed to an assigned water line, but a scale of displacement can be obtained for every depth of immersion, from rabbet to sheer strake, and this diagram signed by the constructor of the hull and filed with the club to which the yacht belongs should be held as accepted authority for the displacement. In this manner, then, I propose that the indispensable element of displacement could readily and correctly be obtained. Regarding an estimate for the comparative powers of engines it is desirable not only to reduce the elements to the least practicable, but to avoid all having variable proportions, thus restricting the elements to those only of comparison. Hence the incorporation by Mr. Kemp of the diameter of the steam cylinders with the area of grate in a computation for comparative power of two yachts is not only unnecessary, but erroneous; thus, with two yachts of like models and draughts of water, with like boilers and consumption of fuel, cylinders of like stroke of piston but differing in capacity (proportional to the pressure of steam the owner or builder may prefer to operate with), and, consequently, in their diameter, and assuming grate 50 square feet, cylinders of No. 1, 20 and 36 in. and of No. 2, 26 and 46 in.; then by rule:—

$$\begin{array}{rrcrr}
\text{No. 1—}20^2 = & 400 & \qquad & \text{No. 2—}26^2 = & 676 \\
36^2 = & 1296 & & 46^2 = & 2116 \\
\hline
4) & 1696 & & 4) & 2792 \\
\hline
 & 424 & & & 698 \\
50 \times 10 = & 500 & & 50 \times 10 = & 500 \\
\hline
 & \dfrac{924}{2} = 462 \text{ I H P} & & & \dfrac{1198}{2} = 599 \text{ I H P.}
\end{array}$$

But by actual operation their powers would be essentially identical. Hence, with like vessels and powers under the operation of this rule one would be penalized for power 34 per cent. above the other.

In additional illustration of the preceding formulæ I submit the following elements of a yacht with which I am familiar:—

$D = 181$; $S = 14$ and $I\ H\ P = 460$. Then $14^3 \times 181\frac{2}{3} \div 460 = 87808 \div 460 = 190.8$, coefficient, and

$$\sqrt[3]{\frac{190{\cdot}8 \times 460}{181\frac{2}{3}}} = \sqrt[3]{\frac{8780{\cdot}8}{32}} = 14 \text{ knots.}$$

If, therefore, an assigned coefficient of 215, as submitted by Mr. Kemp, was taken in this case, her capacity for speed would be computed at

$$\sqrt[3]{\frac{215 \times 460}{181\frac{2}{3}}} = 14{\cdot}57 \text{ knots,}$$

by which she would be charged time 4 per cent. in excess of that due to her power and displacement, = one knot in 25.

As the combustion of the fuel in a boiler is the source of the power of an engine, the surface area of the grate alone, but for the varying methods of combustion as by natural draught, steam jet, exhausting draught, or pressure blast, could with propriety be taken as the exponent or measure of that combustion, and hence a measure of the power could very easily be arrived at. To make the grate surface then of uniform value, when the combustion under the methods above given would vary from 13 to 25, and even to 40 pounds coal per square foot of grate per hour, is an operation not to be entertained; consequently, the rule of measurement as submitted by Mr. Kemp, wherein the grate surface, independent of the method of combustion, is taken, fails to meet the requirements of the case.

A review, then, of the elements existing and of their operation furnishes the following:—

1. Displacement of the hull can readily and correctly be arrived at by the possession and computation of a scale displacement.

2. The exact powers of the engines of competing yachts can only be arrived at with full satisfaction to all parties by the result of the observation and operation of a committee of at least three engineers, whose duty it would be to examine condition of flues and grates of boilers, condition and adjustment of engines, to require the use of coal of an average quality, and to operate the boilers and engines to their full capacity, and to obtain indicator cards from which their powers could be correctly computed and taken as standards thereof.

3. If the preceding method should be objected to because of the details involved, or impracticable at certain localities for want of all the necessary experts, a very practicable and a fair result can be arrived at by the assignment, by a committee of engineers, of a standard evaporation per square foot of grate for the different methods of combustion, computed in combination with their capacity of cylinders and ratio of expansion.

4. If objection should be entertained in consequence of making the boiler the essential element of determination of power, I hold that, inasmuch as the combustion of the fuel is its source, and that the only variable elements connected with it, when of a like composition, are the methods of combustion and the type of boiler, that the design and its proportions and consequent consumption of fuel are as essential and equally as fair a test of merit in the general design and construction of a steam yacht as that of the area, location and trim of sails in a vessel designed for canvas alone.

5. The comparative propelling capacity of steam yachts can be obtained by taking the surface area of their grates at natural draught, adding thereto an assigned factor for the different methods of jet and blower combustion, all of which can, with all necessary exactness, be deduced by a committee of engineers.

6. Having obtained displacement and power, it then becomes necessary to apply them to the requirements of competition, and in order to attain this, it must first be determined whether allowance of time is to be made for an assigned distance run, per speed, or per time per hour; and second, what this allowance should be. And these are results that can be only justly arrived at by being confided to the decision of a combined committee of expert engineers and yachtsmen.

The problem, then, of how a just standard of comparison of the powers of steam yachts and the allowances therefor are to be readily and satisfactorily arrived at I have not assumed to solve or to indite rules for, but in contributing to the elements by which the solution and rules are both to be reached I have essayed, in compliance with your request, to facilitate the attainment of so desirable a result.

CHAS. H. HASWELL.

Notes and Novelties.

Eddystone Lighthouse.—The New Eddystone Lighthouse is to be provided with two fine bells of two tons weight each, and the Trinity House has commissioned Messrs. Gillett & Bland to cast them. Their dimensions are:—Height from shoulder to lip 3ft. 8 in.; total height from lip to upper surface to the mushroom suspender, 4 ft. 6 in; diameter at shoulder, 2 ft. 10 in.; diameter at lip, 5 ft. 1¼ in. In the foundry at Croydon a large number of visitors witnessed one of the Eddystone bells already cast, undergoing the process of bright turning of the upper part; presently it will be turned bright along a portion of the lower part for the sake of ornamentation. When this is done the bell will be up-ended and tuned to a perfect note. All bells are cast with their notes sharp, and the flattening of the note is then accomplished by turning away more or less of the inner surface of the lip. To sharpen a bell's note there must be a slicing away from the lip, and this cannot be done to any extent. In the foundry, also, were specimens of moulds of bells in perfect series, and ingots of the bell-metal of which the new bell—the second Eddystone bell—was to be cast. Here in the metal a marked advance is made. The alloy is carefully made by puddling in a reverbatory furnace, so that it is already a very perfect alloy when it is cast into ingots. These ingots are again put into the reverbatory furnace for the casting charge. At about a quarter to five the casting charge was ready for running; the moulds were all finished up, and the leading trough loamed along its length. The foundry was crowded with visitors, the ladies being not less than equal in proportion, and displaying lively interest in the proceedings, and very intelligent appreciation of the different operations. The furnace-stopping being broken in, the dull red highly fluid metal poured forth, disappearing into the depths of the mould for about a minute and a half; it then rose bubbling up and filled the upper spaces, forming two hot lakes above the casting. These are intended to give a head or weight of metal to render the bell homogenous and firm in structure when cold. Two or three extra crucibles of molten metal from auxiliary pits were poured in, making altogether 48 cwt. or 50 cwt. of metal. The work was performed by four men without a hitch of any kind, and the promise of a very fine bell will, we doubt not, be duly realized when the bell is exhumed.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 21st June, to 23rd July, 1881.

2717. H. H. Lake (communicated by E. J. Hale). Feed water heating.
2723. G. Leslie. Raising and lowering screw propellers.
2728. W. Smith. Excavation of harbours, &c.
2749. A. Higginson. Steam and hand steering gear.
2756. G. A. Cochrane. Perishable goods storage.
2765. J. Levassor. A new motive power.
2778. W. Cook and D. Mylchreest. Steam generators.
2799. R. Thomson and J. Watson. Steam boilers.
2800. G. R. Renshaw. Engine reversing gear.
2808. J. G. Jebb (communicated by W. B. Barker). Signalling by sound.
2828. J. Colling. Ventilating vessels.
2842. G. O. Topham. Motive power engine.
2861. F. H. F. Engel (communicated by A. W. Schultze and G. Meyer). Steam boilers.
2870. J. Chapman. Condensing steam engine.
2884. L. C. Neebour. Davits, and boat raising and lowering.
2912. G. Kingdon. Vertical steam boiler.
2924. G. W. Robertson and J. Beck. Combined steam and hand steering engines.
2925. H. Bonneville (communicated by P. Alfieri). Boiler incrustation removal.
2933. W. Hargreaves and W. Inglis. Valve gear.
2944. J. P. Hooper. Telegraph cables.
2973. W. C. Pagan and J. Hove. Indication of direction and motion of engine shafts, &c.
2983. R. J. Meek. Application of wave and tidal power to propelling, &c.
2992. J. E. Outridge. Motive power engines.
2996. W. Coppin. Propulsion and construction of vessels.
3001. H. Terrell. Anchors.
3004. G. Furness and J. Robertshaw. Steam pressure gauges.
3008. W. R. Lake (communicated by J. Menge). Dredging machines.
3021. R. M. Marchant. Automatic cut-off and engine regulator.
3033. A. C. Henderson (communicated by D. F. Trefcon). Life preserving corsets.
3059. J. Ingleby (communicated by J. Pechan). Transhipping from rail to ship.
3065. E. A. Brydges (communicated by J. B. Merkl). Propelling mechanism.
3086. A. M. Clark (communicated by I. P. Travers). Hammocks and suspension attachments.
3094. H. J. Allison (communicated by T. G. Widmer). Propelling and increasing buoyancy of ships.
3103. R. F. Fairlie. Construction of ships.
3121. G. W. Hart. Range finder.
3126. F. H. F. Engel (communicated by J. Empon & Co.). Boiler tubes.

⁂ Any information regarding these or other patents will be gladly furnished on application.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

June 25th, 1881.

Bray, George E.	2 C	London.
Campbell, Peter	1 C	Lvrpool.
Cannell, Angle G.	2 C	do.
Carnegie, James	2 C	do.
Clarke, John	2 C	N Shlds.
Davidson, James	2 C	Lvrpool.
Erskine, George	2 C	London.
Gregory, Alex.	2 C	N Shlds.
Hawthorne, Jas. G.	2 C	Hull.
Inglis, Alex. S.	2 C	Abrdn.
Jeffcott, John E.	2 C	Lvrpool.
Jones, David	2 C	Bristol.
Lawther, Wm. J.	2 C	London.
Leslie, W.	1 C	Abrdn.
Mackinzie, Jas. A.	1 C	London.
Munro, Donald	1 C	Lvrpool.
Nash, James	1 C	London.
Shepherd, Wm. T.	2 C	N Shlds.
White, Sampsn. G.	2 C	London.
Willis, Llewellyn	1 C	Bristol.

July 2nd, 1881.

Allan, Charles	1 C	London.
Bell, William	1 C	Sndrlnd.
Brodie, Alexander	2 C	Glasgw.
Buglas, Thomas	1 C	Sndrlnd.
Carty, R.	1 C	Lvrpool.
Coutsonpiadi, Mathew	1 C	do.
Flack, George	2 C	Lvrpool.
Grant, John	2 C	Glasgw.
Glen, Alexander	1 C	Sndrlnd.
Gouldie, Robert	2 C	Glasgw.
Hull, Charles	2 C	Lvrpool.
Johnson, Samuel	2 C	do.
Johnston	1 C	Glasgw.
Kirtley, Wm. J.	1 C	N Shlds.
Logan, David L.	2 C	Glasgw.
Martin Charles	1 C	Lvrpool.
MacMillan, Alex.	2 C	Glasgow
MacMillan, John	1 C	do.
McIntyre, Cmpbll.	1 C	do.
McLaren, William	2 C	Sndrlnd.
Murphy, John	2 C	Lvrpool.
Nelson, Frederick	1 C	Sndrlnd.
Poulson, John	2 C	N Shlds.
Robertson, Hny. J.	2 C	do.
Scott, Walter	2 C	do.
Sinclair, John	2 C	Lvrpool.
Thomas, Thomas	1 C	Sndrlnd.
Turnbull, James	2 C	Lvrpool.
West, Henry E.	1 C	London.
White, Fred	1 C	Sndrlnd.
Wright, Edwd. C.	2 C	N Shlds.

July 9th, 1881.

Ellis, George	2 C	Lvrpool.
French, Thos. G.	2 C	London.
Furniss, Jno. W.	2 C	do.
Galloway, Wm.	1 C	Lvrpool.
Glen, James	2 C	London.
James, George	1 C	Plymth.
M'Ewan, John	2 C	Lvrpool.
Rimmer, John S.	1 C	do.
Roberts, Robert	2 C	do.

July 16th, 1881.

Adamson James	2 C	Lvrpool.
Appleton, John J.	2 C	N Shlds.
Carlile, Wm. A.	2 C	Lvrpool.
Clarke, Thomas T.	2 C	N Shlds.
Coverdale John G.	1 C	do.
Crompton, Ths. A.	1 C	London.
Davis, Edward N.	2 C	do.
Dykes, John	1 C	Glasgw.
Findlay, Andrew	2 C	Lvrpool.
Findlay, Dawson J.	2 C	N Shlds.
Graham, George	1 C	Leith.
Hall, Thomas	1 C	do.
Hamilton, Robert	1 C	Grnock.
Harrow, Richard	2 C	Leith.
Hughes, David	2 C	Dublin.
Hughes, John	2 C	do.
Inglis, John	1 C	London.
Kirby, William E.	2 C	S'amptn.
Knight, William	2 C	Glasgw.
Lees, James	2 C	Lvrpool.
Legge, John	1 C	Leith.
McIntyre, Daniel	2 C	Glasgw.
Millar, David	2 C	Leith.
Neill, William	2 C	Glasgw.
Redy, James D.	2 C	N Shlds.
Sorensen, Amandus	1 C	do.
Steen, Richd. A.	1 C	Hull.
Stuart, Joseph	2 C	N Shlds.
Tate, Thomas	2 C	Hull.
Taylor, John	1 C	Lvrpool.
Taylor, Wm. A.	1 C	Leith.
Thrash, Thos. A.	1 C	Lvrpool.
Turton, Thos. L.	2 C	London.

July 23rd, 1881.

Alderson, Thos.	2 C	London.
Benson, Henry	2 C	Lvrpool.
Blair, James	2 C	do.
Buyers, Wm. B.	1 C	Abrdn.
Crane, Alexander	2 C	do.
DeSilva, David	2 C	Lvrpool.
Douglas Chas. H.	1 C	N Shlds.
Esdon, John G.	1 C	Lvrpool.
French, John G.	1 C	N Shlds.
Gibson, James	1 C	London.
O'Donnell, James	2 C	Lvrpool.
Phillips, Walter	1 C	London.
Rochester, W.E.H.	2 C	N Shlds.
Sinclair, Jas. F.	1 C	London.
Stratham, George	1 C	N Shlds.
Thompson, Alfd. E.	2 C	Lvrpool.
Walker, Andrew	2 C	N Shlds.

ROBERT JACKSON, Registrar-General.

General Register and Record Office of Shipping and Seamen.

32, Basinghall Street, London, E.C.

THE German Admiralty has decided upon the construction of a number of gun-vessels of an improved type. They will be armour-plated, and armed with one large gun and six machine guns, and two ports for discharging fish torpedoes. The tonnage is to be 950, with indicated horse-power of 1,400 horses which, it is calculated, will give a speed of over 14 knots.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, SEPTEMBER 1, 1881.

EDITORIAL NOTES.

It seems that we are yet but novices in the art of naval architecture. Such a statement may sound absurd to those experienced men whose lives have been spent in wave theories and most perfectly proportioning the hulls of the present day. But what do such constructors say to a vessel which shall steam at a speed of 30 to 40 knots, with only a moderate exertion of power. This, they will be inclined to say is a chimera, but this result seems to be brought at least within the bounds of possibility by the researches and experiments of Professor Raoul Pictet, of Geneva. The invention of the Professor follows the idea of the familiar "duck and drake" of a flat stone. That is to say, he has conceived the idea that high velocity should be utilized to raise the vessel out of the water rather than to force it through the water with an increased immersion. The Professor has succeeded in constructing a model, which demonstrates the easibility of this idea with a certain construction of hull. The immersion at the bows is reduced from 6 to 3 inches at speed, and proportionately throughout the length of the hull. The vessel is driven by a pair of side paddle wheels. Should all these results be confirmed by further constructions on a larger scale, this invention promises to revolutionize marine construction—at least for speed.

The submarine torpedo boat invented by the Roumanian engineer, Trajan Theodoresco, which we have already referred to, seems to be an accomplished success. We understand that the boat may be navigated under water at a depth of 100 feet for 12 hours at a stretch. She can, however, descend without difficulty to a depth of 300 feet. On the surface of the water the boat can be manœuvred under the ordinary conditions of a steam-boat. She is not, however, very fast above water—not exceeding 8 or 9 knots an hour. She has the specialty of providing her own light when immersed. She can project the light, so as to show obstacles clearly at a distance of 130 ft., so that there is time to avoid them. The air supply will last for from 12 to 14 hours, and it can be renewed from the surface by means of a telescopic tube and pumping apparatus. The propulsion of the vessel, and its submersion are effected entirely noiselessly. A vessel, having all these peculiarities would certainly prove a most dangerous foe, and might be turned to profitable account in times of peace by diving for sunken treasure, or the light movables on board sunken vessels.

China is fast disabusing the Western World of their idea that she is too stupid or conservative to graft modern inventions upon her antique systems. It is mostly, however, in her Navy that the greatest strides have been made. Her junks have proved much more seaworthy and enterprising than would be at first imagined. She is, however, fast replacing her ancient war-ships by the latest improvements in gun-boats. These gun-boats, though small, are the most powerfully armed iron-clads in the world. She is now purchasing heavy guns from the great founders at Essen, and a large consignment of fish torpedoes from the Schwartzkoff works at Kiel. It is noteworthy that her first great advances are in warlike arms, and it is frequently to be noticed that this is the first assumption of civilized manufactures by barbaric nations. It is to be hoped that these first essays towards civilization will be followed by the adoption of other inventions of Western ingenuity, tending more directly towards commercial advantage and progress.

WE understand that a Mr. Sayers is advocating the adaptation of air bags to the sides of a ship as a protection against sudden sinking. To effect this purpose large air-bags of suitable water-proof or impervious material are enclosed in a string or cord netting attached to a strong rope. The rope passes over pulleys, one at the bottom of a strut, which projects from the side of the vessel, and others so placed that the cord runs inboard on deck. When not required the strut lies flat against the ship's side, and the bag, we presume, is laid by, flat, out of the way, on deck. Should any serious leak occur, a number of bags may be rapidly blown out, and lowered over the ship's side, the struts at the same time being fixed so as to support the air bags clear of the ship's side. As the bags may be blown out and lowered in a few minutes there does not seem much danger of vessels sinking suddenly for the future. This is provided that the air bags, of which we do not doubt their buoyant power, and their attachments are strong enough to support the vessel to which they are attached.

MUCH work in marine foundations is now effected by the discharge of rubble or concrete blocks on the chosen sites. This method of construction is found equally effective and much more cheap and rapid than construction behind dams or in caissons could ever be. To effect these operations the rubble or concrete are conveyed by barges from which the rubble is discharged by spade or crane labour. We note a very ingenious invention from America in the screw or barge for such a purpose, may be made in two watertight compartments jointed in the centre, which are made to open along the line of the keel by suitable gearing, the load being discharged downwards through the opening so made. The interior lining or deck of the barge is made in a double incline towards the keel, showing when the barge is closed to receive its load a V-shaped hold into which the material is filled. The barge is held fast in this position by suitable catches. When these catches are released the weight of the load itself suffices to force aside the two hinged watertight compartments of the barge, and allows the material to fall through the opening thus made in the keel.

THE discussion raised by Mr. Price on the comparative value of cargo-carrying vessels built in steel or iron is one of the greatest interest to ship-owners and builders. It is strange that such an important discussion was not aided by the opinions of ship-owners, ship-builders, and sea-going engineers, rather than restricted to the views of a body of merely mechanical Engineers. Mr. Price, the general manager of Palmer's Shipbuilding Company, one of the few of those discussing the question who had thorough practical knowledge of his subject, advanced many weighty arguments in favour of the theory that an iron built ship pays the ship-owner better as a general cargo-carrying vessel than a steel-built one. We are certainly inclined to agree with him, for many reasons. First and foremost the first cost of an iron vessel will average at least £3 a ton cheaper than if it were built in steel, and there must be a great advantage in either long life or increased cargo capacity to pay for such an extra outlay. We may suppose that the relative strength of an iron and steel vessel with the above mentioned difference of cost, are about the same, so that we must look elsewhere for the advantages. We fail to see where, for average cubic capacity cargo, the steel ship 10 per cent. lighter is able to carry an equivalently larger cargo. We know that, in average times the difficulty is to get a sufficiency of cargo at all, and not how to carry a 10 per cent. heavier cargo than usual. Very often this could not possibly be done even if freights were plentiful, as frequently the cubic capacity is crowded long before the maximum dead-weight cargo is reached. The only exceptions to this would be in the case of dead-weight cargoes of ore, but the dead-weight cargoes are, we should imagine, but a very small proportion of the average cargoes. That iron ships amply pay for their extra cost over wooden vessels is amply evident from the practical indestructibility. We know of some of the first iron cargo vessels which have been running nearly thirty years, and are practically, with a few repairs, as good as ever. With steel there is no proof that any longer life can be obtained, and there is thus no advantage left that we can see except greater speeds for passenger vessels and greater capacity for dead weight cargoes only.

ASBESTOS PACKING.

THE United Asbestos Company, Limited, seem to be rapidly developing their business, as we have received a notice of their removal to more extended premises at 161, Queen Victoria-street. This Company thoroughly deserve their success from the principles on which they transact their business, viz., to supply only the best and purest article at a fair price.

Asbestos has been much tested and tried lately for gland packing and high pressure steam joints, and many are the different reports about it. Some find it admirable and practically indestructible. Others, however, say that the packing they have used has broken to powder under pressure in the gland, and blew away very much to the injury of the machinery and their own lungs. In some cases, too, we have heard instances of deep corrosion reported as occasioned by asbestos packing.

We think we can do good service to those who may have experienced these disadvantages by telling them that asbestos differs in its fibre and quality from different mines as much as iron or any other mineral. To obtain strong and tenacious, then, a fair price must be paid for it, and the right article found. The United Asbestos Company have the credit of possessing all the best Italian mines, and make an asbestos with a long, tough fibre. The best thing an engineer can do is to try it.

The corrosion also is frequently and chiefly caused by the impregnation of acid in the fibre which had been used to clean the fibre instead of mechanical means, as it may have been too tender to withstand mechanically cleaning.

This danger again the United Asbestos Company avoid by using no acid at all in the cleaning of their fibre. These points are worth knowing, as a valuable material such as asbestos has been frequently discredited by the failures of inferior qualities.

CORNISH'S LIFE-SAVING APPARATUS.

SOME further interesting experiments with this apparatus have recently been conducted at the Charing Cross Floating Swimming Bath. This apparatus we have already favourably spoken of, and Mr Cornish's many years' devotion to rendering articles of ships' furniture capable of supporting swimmers at sea, deserves substantial recognition at last. The floating mattresses each suffice to support one or two persons, and when combined in a raft would form a most buoyant and valuable means for saving life. The seats and cushions of steam-boats, yachts, or pleasure boats could be all so constructed as to enable one or more individuals to float with safety on the water.

The pillow life-belt is a most useful and handy article, which can be instantaneously attached to the body, and will ensure the support of the swimmer in the proper position, and not feet uppermost, as is too frequently the case with ordinary life-belts.

The life-buoy, as patented by Mr. Cornish, is quite different in shape to the old fashioned circular one. It is something in the shape of the letter H. The swimmer to be supported rests easily on the middle bar, either on his chest or back, and thus has his arms free with which to signal, as his body is supported far out of the water. Mr. Cornish demonstrated at the Baths the ease with which a drowning man could be rescued, when the rescuer was aided by such a life-buoy. In one of the experiments, as many as four persons were hanging on to the life-buoy and were easily supported.

The mattresses are so buoyant that one of them supported a weight of 42 lbs. as well as a man. As these mattresses and ship-fittings do not cost more than those usually supplied, there is no doubt that the public would be sufficiently appreciative of such an extra guarantee of safety to more than repay a ship or boat proprietor for his enterprise in adopting these useful fittings.

MILD STEEL IN FRENCH ARSENALS.

On the Use of Mild Steel for the Construction of the Hulls of Ships in the Arsenals of the French Navy.

By M. MARC BERRIER FONTAINE, Member.

(*Continued from page* 105.)

I HAVE collected an account of the ordinary prices paid in the French Navy for the steel of different shapes used in it, these prices having been calculated from the different tenders accepted by it during two different biennial periods, the first comprising the years 1873 and 1874, during which the use of steel was largely developed for the construction of the ships of the fleet, the second period comprising the last two years 1879 and 1880. A comparison of the mean prices thus brought together shows that in the interval of six years, which separates the two periods named, the mean price of steel plates has fallen 56·2 per cent., and that of steel angles 46·2 per cent., while the price of moulded steel bars, not being angles, has only diminished during the same interval of time by 11 per cent. I have also collated, for the sake of comparison, the mean price of iron of different shapes which has been delivered to the Navy in compliance with a certain number of contracts entered into on its behalf during the last year. Finally, I have applied all these mean prices, obtained as I have said, to the total quantities of plates and moulded bars, both in steel and iron, which have been actually ordered for the construction of the hull of the first-class ironclad, the *Foudroyant*, and I have calculated within what comparative limits the total weight and the total cost of the material would be altered in each of the two hypotheses following, first, supposing this particular ironclad to have been built entirely of steel, including even the exterior part of the hull, or, secondly, altogether in iron. It appears from this comparison that if we took severally for unity the total weight and the total price of iron which would have been required in a case corresponding to the last of the preceding supposition, the substitution of steel for iron in all parts of the construction, with the exception of the external plating of the hull, would permit us at the present day to effect a saving in weight of 17·1 per cent., and a saving in cost of 7·7 per cent., while if, moreover, the external plating of the hull had been also made in steel, the savings in question would have become as follows: in weight 20 per cent., and in cost 12·4 per cent. I cannot drop this subject without pointing out besides, that a fighting ship is not, like the merchant ship, obliged to carry a cargo of which the weight must be left undetermined within certain limits, subject only to its being possible to retain the same displacement when fully loaded, with the same dimensions and the same external form when the weight of the hull is either increased or diminished more or less, provided always that this increase or diminution of weight in the hull is compensated for by a corresponding diminution or increase in the weight of the cargo. A ship of war, on the contrary, is constructed to fulfil certain perfectly determinate conditions; to carry, for instance, an armament of which the total weight is exactly fixed beforehand, and which cannot be reduced without bringing about a corresponding reduction of one at least of the qualities which have been accepted as necessary. The weight of the hull of such a ship cannot therefore be increased without involving, as its necessary consequence, a corresponding increase of capacity, and again in the weight of the driving machinery, if we wish the enlarged ship to retain the same speed; and, further, an increase in the coal supply if we wish the ship to be capable of steaming the same distance, and so forth; that is to say, we are involved in a whole series of increments which all tend towards the same result—a considerable increase in the dimensions and total weight of the ship when ready for sea. If, for example, the hull of the *Foudroyant* had been built of iron instead of steel, it would have been necessary to increase its dimensions considerably, and we cannot estimate this increase at less than 1,600 tons for the load displacement.

I do not think it is necessary to reason out any further these considerations in order to put in a clear light the importance of the marked saving which the substitution of steel for iron now permits us to secure for ships of war. As I have said before, the constructors of the French Navy have thought it necessary, up to the present time, to adhere to the use of iron plates for the outer plating of the hulls of all vessels of any importance which form part of the fleet. The difficulties which we formerly had to encounter in fashioning steel plates into the abrupt and varying forms which had to be given to the garboards and to the plates at the two ends of the ship, difficulties pointed out in 1875 by M. Barba,[*] must not be looked upon at this day as among the reasons which still actuate the directors of the Navy in not carrying the use of steel into the parts in question, but that it is clearly shown that steel plates can practically be brought to such shapes if they were suitably treated.

Among the reasons which were formerly stated for retaining the use of iron in the exterior plating of the hull there is only one which still exists, and that is the uncertainty which still remains as to the behaviour of steel plates in sea-water. It must be admitted that the experience of the French Navy, although by no means very extensive on this point, is not very favourable to the abandonment of iron plates for the special purpose in question, for there is evidence that steel plates, when wetted with sea-water, rust much more quickly than iron plates do under similar circumstances. It also appears that the conditions on which the corrosion of steel plates depend are extremely complex, and that they are, for instance, much more active in the comparatively warm water of the Mediterranean than in the colder water of the ocean. I will quote as examples two gunboats, the *Epée*, built at Lorient, and the *Tromblon*, built at Toulon, whose hulls, completely steel-plated, have each of them given proof of rapid and deep corrosion. The *Epée*, however, could be kept afloat in the brackish and muddy water of the port of Lorient formed by the Scorff river. The *Tromblon* was launched at Toulon on the 20th January, 1875, and remained afloat until the 27th October of the same year. During that period of nine months it has been necessary to dock her three times, that is to say, about every two months, to paint the hull, the plates being so rapidly and deeply attacked, especially in the neighbourhood of the water-line. Instead of spreading more or less uniformly over the whole surface of the plate, as usually happens with iron hulls, the oxidation seemed to spread by preference in the direction of the thickness of the plates from the points which were first attacked, by forming a series of pittings of great relative depth, and if there had been any considerable delay in re-painting the hull in the neighbourhood of the water-line, the plates, the thickness of which does not exceed 5 mm., would have been quickly perforated at a good many points. Finally, the progress of the corrosion of this steel-plated hull went on with such unusual rapidity that when the time came to pass the *Tromblon* into the reserve, it was thought necessary, instead of keeping her afloat, to haul her on to a slip, where she will be kept dry until fresh requirements of service oblige her to take the sea again. It is very likely that the true causes which govern this phenomen of exceptionally quick oxidation in steel plates wetted with sea-water will one day or other be completely investigated. When the causes of the evil have thus been determined it may be easier to find a remedy for it, but it must be admitted that the experiments which have been made on the subject at various places have not yet given very conclusive results. It would not be safe to affirm very positively, for instance, that this extremely rapid corrosion of steel plates is solely due, as Mr. Barnaby[†] assumes, to intense galvanic action arising between the metal and the black oxide by which it is covered, and that consequently it will be sufficient to clear the plates of this black oxide by means of a weak acid bath in order to make their oxidation in sea-water slow and uniform, like that which usually takes place on the surface of iron plates. It could not be affirmed with any certainty either that the greater or less rapidity with which steel plates are attacked by rust depends solely on the greater or less proportion of manganese which they contain, as has been suggested by Dr. Siemens, in 1878, in a paper read before this Institution, a suggestion, however, thrown out with some degree of doubt.[‡] Finally, it cannot be affirmed, as has been recently stated before another society, that the corrosion of iron and steel plates is the more slow and regular in proportion as those plates contain a greater proportion of carbon or phosphorus, and that it is consequently not possible to find plates which possess the necessary ductility in combination with the valuable property of being attacked by rust only in a slow and regular manner when exposed to sea-water.

The very diversity of opinion which I have just mentioned proves clearly that these statements can only be received as suppositions agreeing more or less roughly with the observed facts. Whatever be their real value, the French Navy, paying attention principally to the positive lessons of experience, acts doubtless prudently in refusing to substitute steel for iron in the external plating of its ships while there remains any uncertainty as to the causes which bring about on the surface of steel plates in sea water such abnormal corrosion as has been observed upon the hull of the *Tromblon*, and until we discover more effective methods of guarding against such deep and rapid corrosion.

Finally, I must point out, in a few words, what are the reasons which have until now decided the French Navy in retaining the exclusive use of iron rivets to fasten together the various parts of these new constructions in steel, although in reality these reasons do not differ materially from those which have been several times stated before this Institution, especially in 1878, by Mr. White and by Mr. John, in the discussion which followed the very interesting communication of Mr. Martell "On Steel for Shipbuilding."[‡] The French constructors are, like them, very far from assuming that the use of steel rivets may not some day give satisfactory results; but the cases in which steel rivets have hitherto been used do not seem to them sufficiently numerous, nor does the experience which results from them appear to have been sufficiently extended, nor sufficiently conclusive, to allow them to consider themselves in a position to dispense with the use of iron rivets.

As Mr. White pointed out very justly in the discussion which I have mentioned, on the use of iron rivets to connect the different portions of a steel frame, if we wish to preserve, as is suitable, the homogeneity of resistance in the joints, that is to say, equality of resistance between the rivets and the plates, it is only necessary to increase, in a very small ratio, the diameter of the rivets, or (which is preferable) the number of the rivets with a slight diminution of pitch. This proportionate increase may evidently be the less, accordingly as the tensile strength of the iron, of which the rivets are made, approaches that of steel. Now the French Navy only uses in its rivets—the whole of which are manufactured in its own yards—scrap iron, charcoal-made, and of quite exceptional testing. To be accepted, this iron must undergo with success severe forge tests and rivetting tests as well as breaking tests, in which the tensile strength or fracture must not come out below 35 kilogrammes per square mm., the corresponding elongation never being allowed to fall below 12 per cent., while the results actually obtained in these last tests usually indicate a tensile strength at fracture of from 38 to 42 kilogrammes per square mm., with a mean elongation of nearly 20 per cent.; that is to say, coefficients of tensile strength and elongation not much below those of the mild steels which could alone be substituted for the iron in question as material for the rivets. It will be easily understood that, this being the case, the French Navy would apparently gain no advantage, so far as at present appears, from substituting steel for iron as the material for rivets, and that it consequently prefers to go on making use of iron rivets of the best quality, which offer a better guarantee of security than could at this date be found in the use of steel rivets.

ON IRON AND STEEL AS CONSTRUCTIVE MATERIALS FOR SHIPS.[*]

By Mr. JOHN PRICE, of Jarrow.

THE object of the present brief paper is to bring into greater prominence than has hitherto been done, the question as to whether it is more economical, for commercial purposes, to build vessels of steel rather than of iron.

This subject has already received considerable attention, but probably not precisely in its relation to the class of vessels chiefly built in the Tyne district, which are essentially cargo carriers. The author will at once assume that a vessel, whether a sailing vessel or a steamer, has, commercially considered, two functions; firstly, to carry her cargo safely and efficiently, and, secondly, to carry it remuneratively to her owner. It is not pertinent to the present inquiry to consider the first of these functions further, it being of course granted as a necessary condition to the second. The iron vessel will therefore be taken as the standard of comparison, both as to cost and sufficiency of structure. The question really is, which of the two descriptions of vessels—steel or iron—can be shown to be the best investment. If we further narrow the question, it takes this form, in which of the two vessels, taking the dead weight or cargo-carrying capacity into account, can the ton of dead weight capacity be got at the lowest cost; for, as this is the unit upon which the ship's earnings are based, it must also be the unit upon which the cost is estimated.

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[*] Op. cit., p. 4 of Introduction.

[†] "On the Use of Steel in Naval Construction;" Journal of the Iron and Steel Institute, 1879, No. 1., p. 53.

[‡] Dr. C. W. Siemens in the discussion on Mr. Martell's Paper, "On Steel for Shipbuilding:" Transactions Institution of Naval Architects vol. xix, 1878, p. 30.

[‡] Transactions Institution of Naval Architects, vol. xix., 1878, pp. 25, 28, 29.

[*] Paper read before the Institution of Mechanical Engineers at Newcastle

The company with which the writer is associated has recently built a vessel of the general description given in the Appendix; and it is proposed to take this vessel, as built of iron, for comparison with a similar vessel, but built of steel, so far as it is practicable to adopt steel instead of iron in her construction, thus securing the reduction allowed from the iron scantlings in use. The reductions take effect only on the material forming the hull of the vessel; and it will be seen from the particulars of the iron vessel in the Appendix that this material amounts to 1179 tons. From the similar particulars relating to the steel vessel, it will be observed that the equipped weight, which in the iron ship is 1740 tons, is 1614 tons in the steel vessel (after allowing for the difference of weight between equal volumes of iron and mild steel); the difference being thus 126 tons. This difference will also be found in the dead weight carrying capacity, on 22 ft. mean draught. It is only by increasing the dead weight carrying capacity, that any commercial advantage is secured by the owner, in adopting steel instead of iron. This is a point upon which there is no question, assuming, of course, that the iron ship is in every way a structure fitted for her purpose. We have, therefore, to inquire under what conditions this 126 tons of additional dead weight capacity has been obtained.

In the first place, in water ballast trim, the steel vessel would draw 6 in. less water. To put her down, therefore, to the same draught as the iron vessel would require her tanks to be increased in dimensions; and, to preserve the same trim, this must mean increased height of tank. As shown in the Appendix, the additional weight of material used in raising her tank to this height would be 8 tons, which would reduce the available additional dead weight from 126 to 118 tons. The effect of this increased water ballast accommodation would further entail the loss of 2900 cubic feet of stowage capacity, equal to 64 tons of stowage capacity, at 45 cubic feet to the ton.

The next and most important condition, under which the net increased dead weight capacity would be obtained, arises from the higher price that would be paid for the steel, as compared with the iron used in the construction of the hull. Before entering upon this, it may be well to state that the reduction of weight, estimated as due to the use of steel, is 14 per cent. of the weight of the iron vessel, which is about the largest rate of reduction found attainable in practice, as recently stated by an eminent Clyde shipbuilder, who has built a very large amount of steel tonnage. The increased cost of the hull is shown in the Appendix (with the additional cost of the extra water ballast required, namely, 8 tons at £9 12. 6d. less discount, and labour at £3 2s. 6d. per ton, total £100) to be £2760; or at an average rate for the 118 tons extra dead weight capacity of £23 8s. per ton. Now we may assume with perfect safety that the iron steamer, such as is described in the Appendix, could be built and equipped ready for sea, including all cost of engines, boilers, &c., for £10. per ton of dead weight capacity. This would make her price for 3235 tons dead weight capacity to be £32,350. Add to this £2760 for the extra cost if the vessel is built of steel, and we have £35,110 as the cost of the steel vessel, for a dead weight carrying capacity of 3353 tons. This shows the average cost per ton of deadweight to have been increased from £10 to £10 9s. 6d., or an increase in the entire cost of 4¾ per cent. In this example, therefore, we have, in addition to a loss of nearly 2 per cent. of cubic capacity, an enhanced cost of 4¾ per cent. per ton of deadweight capacity.

The question of using steel is sometimes considered differently. It is said that the increased dead weight so obtained is a gain of dead weight capacity, which does nothing but earn money, and against which no current charges need be brought, since it is obtained by a simple change of material in construction; and that at an assumed freight, which must be all profit, it will quickly pay for its acquirement. The cost, however, of this increased deadweight is seen to be £23 8s. per ton, whereas the dead weight in the iron ship is acquired at the rate of £10 per ton. It would appear at first sight to be a complete answer to what has been said about this earning property of the acquired dead weight, to point out that the same effect can be obtained by increasing the dead weight capacity of the iron vessel at £10 per ton, instead of £23 8s., the cost of the same in steel; with precisely the same property of earning, and immunity from current expenses, and with the additionl advantage that the propelling power can be relatively increased at the same rate per ton. If, however, the latter advantage were dropped, increased dead weight capacity could be acquired in the iron vessel for about £8 per ton. This appears, nevertheless, to be an entirely fallacious way of looking at the matter. The cost per ton of dead weight capacity should be calculated on the total tonnage, not on the excess. An owner as a carrier has chiefly to consider the total cost of his carrying capacity, and whatever be the unit basis of his calculation, the total cost is the aggregate of the average cost per unit. The question an owner asks himself is, "What will this or that ship cost me per ton of dead weight?" This has been shown to be 4¾ per cent. less in the case of the iron ship than in that of the steel; and as a purely business matter, the fact that a smaller sum is invested for the same net profit would appear to place the iron sailing or steamship, at present, in the more advantageous position as an investment. There is only one condition under which an owner can be placed, where the adoption of steel at its present cost, can be attended with any advantage; and that is where his dimensions are absolutely limited by the conditions of his trade. That condition, however, may be said to exist hardly anywhere in the ordinary carrying trade.

APPENDIX.

Particulars of Steamship taken for Comparison.

Flush deck, with full poop for captain and officers' cabins, bridge house over engine and boiler space, with cabins under for engineers—topgallant forecastle for crew and stokers, iron main deck, wood upper deck, hold beams wide spaced, water ballast in double bottom (McIntyre's plan), in after hold, through engine and boiler space, and 20 ft. into main hold, deep ballast tank to main deck in after hold, class 100 A. Lloyd's, three decks.

Dimensions.

	ft.	in.
Length over all...	300	0
" between perpendiculars	290	0
Breadth moulded	37	0
Depth moulded...	25	9
" of hold...	24	6
	tons.	
Gross tonnage	2285.24	
Net tonnage	1494.75	

Comparison between Quantities for Iron and Steel Respectively.

	Iron vessel.	Steel vessel.
Total equipped weight	1740 tons.	1614 tons.
,, dead weight on 22 ft. mean draught	3235 ,,	3361 ,,
Gross weight of plates	799 ,,	713 ,,
,, ,, angles and packing	380 ,,	340 ,,
Total weight of iron or steel in hull	1179 ,,	1053 ,,
Weight of water ballast in double bottom	270 ,,	270 ,,
Draught in ballast with double bottom full	10 ft. 8 in. mean	10 ft. 2 in. mean
Cubic capacity of hold and between decks	157,000 cb. ft.	157,000 cb. ft.
Height of double bottom in steel vessel (to have the same draught in ballast as iron vessel, not including deep tank)	...	3 ft. 10 in. from top of keel.
Weight of ballast in double bottom about 3 ft. 10 in. deep	...	388 tons.
Extra weight of steel in above tank	...	8 ,,
Cubic capacity of holds, with double bottom raised 3 ft. 10 in. from top of keel	...	154,100 cub. ft
COST OF CONSTRUCTION.		
Tons. £ s. d.	£ s. d.	£ s. d.
Iron plates 799 at 6 0 0 less 2½ p.c.	4,674 3 0	...
,, angles & packing 380 at 5 10 0 ,,	2,037 5 0	...
Steel plates 713 at 9 12 6 ,,	...	6,691 1 0
,, angles 292 at 9 12 6 ,,	...	2,740 5 0
,, bulb 23 at 9 0 0 ,,	...	201 16 6
,, packing 25 at 5 5 0 ,,	...	127 19 0
Labour	3,684 7 6	3,295 10 0
Total cost	10,395 15 6	13,056 11 6
Deduct iron from steel	...	10,395 15 6
Extra cost of steel vessel	...	2,600 16 0

AN ACCOUNT OF EXPERIMENTS MADE BY A BOARD OF UNITED STATES NAVAL ENGINEERS WITH SCREW PROPELLERS OF DIFFERENT MATERIAL AND DIMENSIONS APPLIED TO THE UNITED STATES FISH COMMISSION'S STEAMER "LOOKOUT" WITH THE HULL COPPERED AND NOT COPPERED.

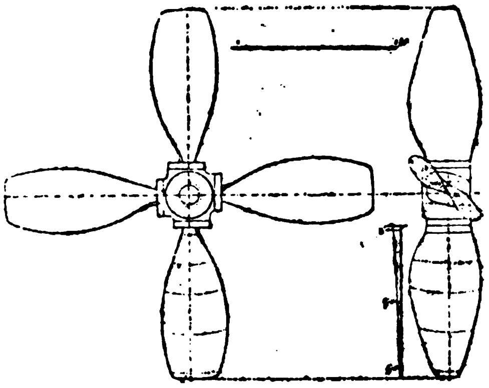
By Chief-Engineer Isherwood, U.S. Navy.

(Continued from page 101.)

THE following are detailed descriptions of each screw, wherein the form of the blade, or its outline, is given, together with its thickness and the diameter of the hub, &c.

Screw *A.*

This screw was of cast brass and had a uniform pitch. The blades, when viewed in projection on a plane parallel with the axis, increased gradually in length from the hub to a radius of 13¼ inches, from which their length gradually decreased to the periphery. The hub was square and the blades—which were cast separately—were bolted to it. The thickness of the blades at the fillet of the hub was 1 1/16 inches.

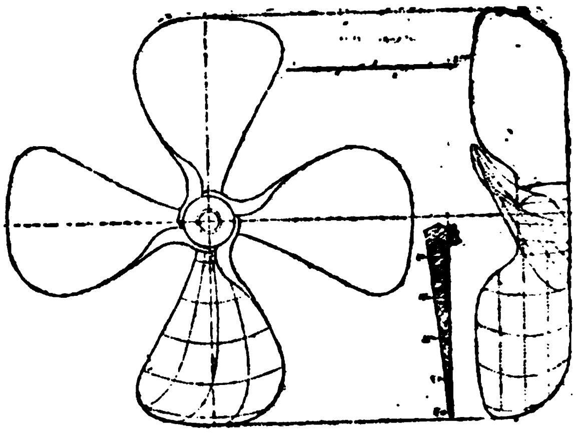


Diameter of the screw	4·6458	feet.
Diameter of the hub	0·8333	feet.
Pitch of the screw	8·4	feet.
Number of blades	4	
Length of the screw at the hub, in the direction of the axis	0·5625	foot.
Length of the screw at radius of 13¼ inches, in the direction of the axis	0·9167	foot.
Length of the screw at the periphery, in the direction of the axis	0·3125	foot.
Mean fraction used of the pitch...	0·3325	
Projected area of the blades on a plane at right angles to the axis	5·4551	sq.ft.
Helicoidal area of the blades	7·9447	sq.ft.

Screw *B.*

This screw was of cast iron, and had a uniform pitch. The hub and blades were cast together. The blades, when viewed in projection on a plane parallel with the axis, had their edges parallel from the hub to a radius of 6½ inches. From this point to a radius of 18 inches the length of the blades gradually but irregularly increased. From the radius of 18 inches to the periphery the length of the blades gradually decreased. The outer corners of the blades were excessively rounded. The hub was cylindrical, and the thickness of the blade at its fillet was 3 inches.

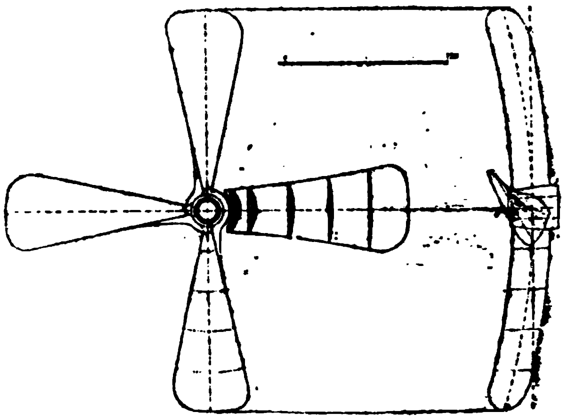
Diameter of the screw	5·00	feet.
Diameter of the hub	0·70	foot.
Pitch of the screw	7·5	feet.
Number of blades	4	
Length of the screw at the hub, and to radius of 6½ inches in the direction of the axis	0·6657	foot.
Length of the screw at radius of 18 inches, in the direction of the axis...	0·5080	foot.
Length of the screw at the periphery, in the direction of the axis	0·5080	foot



Mean fraction used of the pitch...	0·5283	
Projected area of the blades on a plane at right angles to the axis	10·1693	sq.ft.
Helicoidal area of the blades	13·5266	sq.ft.

Screw *C.*

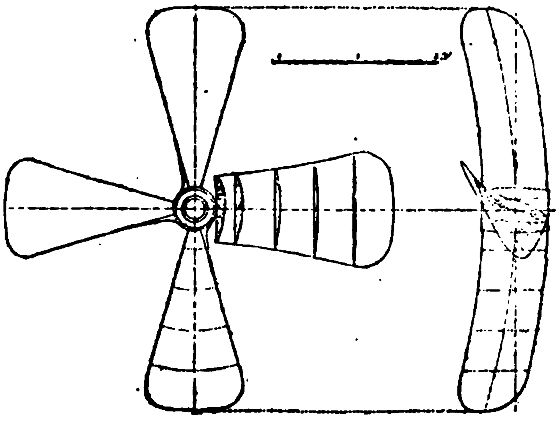
This screw was of cast brass, and had a uniform pitch. The hub and blades were cast together. The edges of the blades, when viewed in projection on a plane parallel with the axis, were parallel segments of circles curving backwards, the radius of the forward edge being 9·25 feet. The outer corners of the blades were rounded with easy curves. The hub was cylindrical, and the thickness of the blade at its fillet was 1¾ inches.



Diameter of the screw	5·0	feet.
Diameter of the hub	0·5417	foot.
Pitch of the screw	7·5	
Number of blades	4	
Length of the screw in the direction of the axis, uniform from hub to periphery	0·5208	foot.
Fraction used of the pitch	0·2703	
Projected area of the blades on a plane at right angles to the axis	5·2457	sq.ft.
Helicoidal area of the blades	6·7860	sq.ft.

Screw *D.*

This screw was of cast brass, and had a uniform pitch. The hub and blades were cast together. The edges of the blades, when viewed in projection on a plane parallel with the axis, were parallel segments of circles curving backwards, the radius of the forward edge being 9·25 feet. The outer corners of the blades were rounded with easy curves. The hub was cylindrical, and the the thickness of the blade at its fillet was 1¾ inches.



Diameter of the screw	5·000 feet.
Diameter of the hub	0·5417 foot.
Pitch of the screw	8·625 feet.
Number of blades	4
Length of the screw in the direction of the axis, uniform from hub to periphery	0·4461 foot.
Fraction used of the pitch	0·1994
Projected area of the blades on a plane at right angles to the axis	3·8697 sq.ft.
Helicoidal area of the blades	5·3470 sq.ft.

Screw *E*.

This screw was of cast brass, and had a uniform pitch. The hub and blades were cast together. The edges of the blades, when viewed in projection on a plane parallel with the axis, were parallel segments of circles, the radius of the forward edge being 9·25 feet. The outer corners of the blades were rounded with easy curves. The hub was cylindrical, and the thickness of the blade at its fillet was 1⅜ inches.

Diameter of the screw	5· feet.
Diameter of the hub	0·5625 foot.
Pitch of the screw	9· feet.
Number of blades	4
Length of the screw in the direction of the axis, from hub to periphery	0·8125 foot.
Fraction used of the pitch	0·3549
Projected area of the blades on a plane at right angles to axis	6·8975 sq.ft.
Helicoidal area of the blades	9·3407 sq.ft.

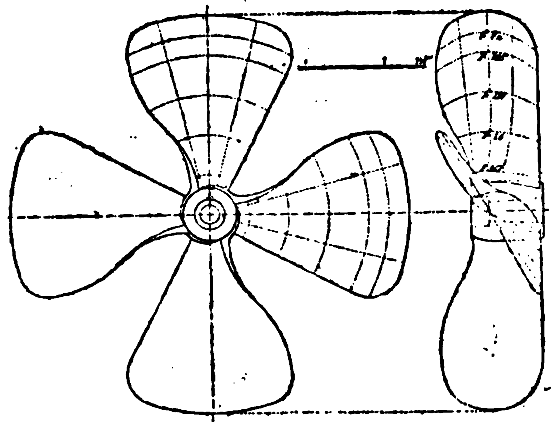
Screw *F*.

This screw was of cast brass, and had a uniform pitch. The hub and blades were cast together. The edges of the blades, when viewed in projection on a plane parallel with the axis, were parallel segments of circles curving backwards, the radius of the forward edge being 9·25 feet. The outer corners of the blades were rounded with easy curves. The hub was cylindrical, and the thickness of the blade at its fillet was 1⅜ inches. In all respects except diameter, screw *F* was the duplicate of screw *E*.

Diameter of the screw	4⅝ feet.
Diameter of the hub	0·5625 foot.
Pitch of the screw	9· feet.
Number of blades	4
Length of the screw in the direction of the axis, from hub to periphery	0·8125 foot.
Fraction used of the pitch	0·3539
Projected area of the blades on a plane at right angles to axis	5·9659 sq.ft.
Helicoidal area of the blades	8·6850 sq.ft.

Screw *G*.

This screw was of cast iron, and had a uniform pitch. The blades, when viewed in projection on a plane parallel with the axis, increased gradually in length from the hub to a radius of 21 inches, from which the length gradually decreased to the periphery. The hub was cylindrical, and the thickness of the blade at its fillet was 4 inches.



Diameter of the screw	5 0 feet.
Diameter of the hub	0·75 foot.
Pitch of the screw	7·9 feet.
Number of blades	4
Length of the screw at the hub, in the direction of the axis	0·8542 foot.
Length of the screw at radius of 21 inches, in the direction of the axis	1·2708 feet.
Length of the screw at the periphery, in the direction of the axis	0·8750 foot.
Mean fraction used of the pitch	0·5736 foot.
Projected area of the blades on a plane at right angles to the axis	11·0098 sq.ft.
Helicoidal area of the blades	14·8453 sq.ft.

EXPERIMENTS.

The experiments were made in the perfectly smooth water of the Potomac River near the City of Washington, over a base of 11⅜ geographical miles, according to the Coast Survey Chart, extending from marks abreast the wharf at Giesborough Point to marks abreast the wharf at Marshall Hall. During all the experiments, the position of the throttle and of the cut-off valves remained the same, nor was there any sensible change in the general state of the machinery. The steam pressure in the boiler was maintained as nearly as possible at 80 pounds per square inch above the atmosphere, and the engine and boiler were managed throughout by the same persons.

Each experiment was made in exactly the same manner. Steam was raised and the machinery operated at the Navy Yard wharf until the fires were brought to steady action, when the vessel proceeded to the nearest terminus of the base, which she passed at her maximum speed for the boiler pressure, when one observer took the time and another the reading of the taffrail log made by Bliss & Co. As the vessel passed the farthest terminus the time and log reading were again taken. The vessel was not put about until at a distance beyond the last terminus that would allow her on the return to pass it at the maximum speed for the boiler pressure, as before. The reading of the engine counter in the engine room was taken simultaneously with the log and time.

The indicators employed were new, and of Thompson's design; during each run, excepting the first four with screw *A*, there were taken by them six sets of indicator diagrams from each end of each cylinder, the diagrams being equispaced over the time. The indicated pressures in the different experiments are the means of all the diagrams taken. During only the last two runs with screw *A* were there any diagrams taken, and the mean pressure from them has been assumed as the mean pressure for the entire experiment.

During all the runs the vessel's trim and draught of water remained sensibly the same.

The experiments with screws A, B, C, D and E consisted of six runs over the base with each, three in each direction, and they were made on three different days, a pair of runs being made in immediate succession on each day. The experiments with screws F and G were made in the same manner, except that they consisted of only four runs over the base, two in each direction, and they were made on two different days, a pair of runs being made in immediate succession on each day.

During experiments A, B, C, D and E the vessel was not coppered, the immersed portion of the hull presenting a planed wooden surface to the water. During experiments F and G this portion was covered with smooth rolled copper.

The speed of the vessel was determined, as stated, by the shore distances and by the taffrail log for each run over the base. The mean of the speeds of the different runs of the same experiment, by the shore marks, is taken as the mean for the entire experiment according to that measurement. And, in the same manner, the mean of the speeds of the different runs of the same experiment by the taffrail log is taken as the mean for the entire experiment according to that measurement. These two measurements differed, and, with a slight irregularity for the different experiments, the mean difference deduced from all the experiments showing, as might be expected, that the indications by the taffrail log were greater than those by the shore marks, the ratio being as 1·0572 to 1·0000. This ratio may be taken as a constant correction for the taffrail log, which, as its determinations were unaffected by current, can be considered, when thus corrected, as the most accurate measure of the vessel's speed. Accordingly, the speed by the log thus corrected is what is given in the following tables.

The mean number of revolutions made by the screw per minute during a run was ascertained from the time and the total number of revolutions given by the counter during that run; and the mean number of revolutions made per minute by the screw during an experiment is the mean of the means of those made during the runs composing that experiment.

(*To be continued.*)

ON THE PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.*

By MR. F. C. MARSHALL, of Newcastle-on-Tyne.

AT the Liverpool meeting in 1872, Mr. F. J. Bramwell, F.R.S., now Sir Frederick Bramwell, past-president, read a paper before this Institution on "The Progress effected in Economy of Fuel in Steam Navigation, considered in relation to Compound Cylinder Engines, and High Pressure Steam." This paper was most exhaustive in its character, and was followed by a discussion, in which some of our most prominent engineers took part.

Having been asked to prepare a paper for this meeting on the marine engine, the writer naturally turned to what had been laid before the Institution on previous occasions. He found that Sir Frederick Bramwell's paper embraced all the past history and present condition of marine engineering, and to some extent forecast its future. On the same occasion Dr. Siemens, F.R.S., the President for the year, remarked that during the nine years which had elapsed since the first meeting in that city the marine engine had been so far improved, that it consumed rather less than one-half the amount of fuel at that former time thought to be indispensable; and that, if nine years hence his successor were able to announce a similar step in advance, we should have the satisfaction of knowing that the further discussion of the subject that day had not resulted in "lost energy."

We have now completed the term then defined by Dr. Siemens; and the writer proposes to continue the subject from the date of that meeting and endeavour to trace out whether any, and if so what progress has been made; further, to consider whether or no we have reached the finality so strongly deprecated by Sir Frederick Bramwell in the discussion referred to, and if not, then in what direction we are to look for further development.

In his paper Sir Frederick Bramwell gives tables of particulars of the boilers and engines belonging to twenty-eight steamers of different descriptions, and comprising nearly all the types of engine and boiler now in general use. These tables embrace the sizes of cylinders, heating and grate surface of boilers, condensing surface, working pressure, speed of piston, indicated power, and consumption of fuel.

The average consumption of nineteen of these vessels he shows to be 2·11 lb. of coal per indicated horse power per hour. The working pressures range from 45 lb. to 65 lb. per square inch, the latter being the highest pressure recorded, while 376 ft. per minute is the average piston speed.

The writer has been favoured with data, from thoroughly reliable sources, showing in a similar manner the general proportions of engines and boilers recently fitted to steamers in the mercantile marine. These are shown in Table No. I., appended. It will be noted that the steam pressures are now much higher, the boilers have less heating surface, and the cylinders are much smaller for the indicated horse power developed; and at the same time the average consumption of fuel is reduced from 2·11 lb. to 1·828 lb., or by 13.38 per cent.

A substantial progress is thus shown to have been made during the nine years; and although it does not reach the enormous gain of the previous decade, it is probably as much as could reasonably be expected, as the closer we approach the limit the more difficult will improvement become.

The marine engine and boiler of to-day is substantially the same in design and arrangement as Sir Frederick Bramwell described it. The compound two-cylinder vertical engine, with receiver, and with two cranks at right angles, is the most commonly accepted type. It embodies great simplicity in design, great facility—and therefore cheapness—in manufacture; it has few moving parts, is easily handled and tended, is very accessible throughout the working parts while in motion, and is readily repaired.

The single Woolf engine, commonly known as the tandem engine, with single crank and flywheel, as shown in Figs. 3 and 4, was originally introduced and developed by Mr. Alfred Holt, and has recently been adopted by some other shipowners, with great satisfaction to themselves. It is still, however, looked upon with doubt and suspicion as to "unhandiness" by shipowners and their engineers generally, and therefore does not make much progress in numbers as compared with engines having cylinders side by side; and this, notwithstanding the undoubted advantage it possesses, of taking up less fore-and-aft space in the vessel, and of having fewer working parts to be looked after.

Next in order of general acceptance to the two-cylinder receiver engine, with cranks at right angles, is that known as the double tandem engine; which consists of two Woolf engines placed side by side, and working two cranks at right angles, Figs. 5 and 6. These engines have been extensively adopted for the largest Transatlantic steamers, and with great success.

The tandem form of compound engine possesses the great advantage of independence of action, and may therefore be multiplied indefinitely in its application to one propeller. It has long been used in the double form, and last year at Barrow it was introduced to the notice of the institution in its triple form, as applied to the *City of Rome*. So long as it is thought wise to concentrate the propelling power of a vessel in one instrument, the number of such engines working side by side may be increased indefinitely. The triple or quadruple arrangement of such engines, as will readily be seen, gives great uniformity of strain and greatly relieves the weight and friction on the crankshaft, as well as balancing all the moving weights. To set against these facts, there is of course the great disadvantage of increased number of parts, always a serious consideration on board ship at sea.

A modification of the Woolf engine, introduced by Mr. D. Rowan, of Glasgow, about the year 1861, has three cylinders, one high and two low-pressure placed side by side, with piston rods attached to one crosshead. It has recently been very satisfactorily applied to paddle engines of large power by Messrs. Douglas Hebson & W. G. Ramsden, of Liverpool. In this case the steeple form of engine is adopted; the three cylinders of each engine are firmly bolted both to each other, and to keelsons fore and aft the vessel, thus forming a very solid and substantial base from which to work the upper framing. Each set of cylinders is worked by one valve and motion, Marshall's arrangement being used. The three piston rods are attached to the moving crosshead, and guided in the usual way.

The engine, the writer believes, is a novelty as thus applied. It can be made to weigh no more than the oscillating form; it has given most satisfactory economical results in working; it is easy to maintain, and affords great facility of access to all the working parts for overhauling and repair when required.

The most recent form of compound engine, introduced into our

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* Paper read before the Institution of Mechanical Engineers, at Newcastle.

Fig. 1.

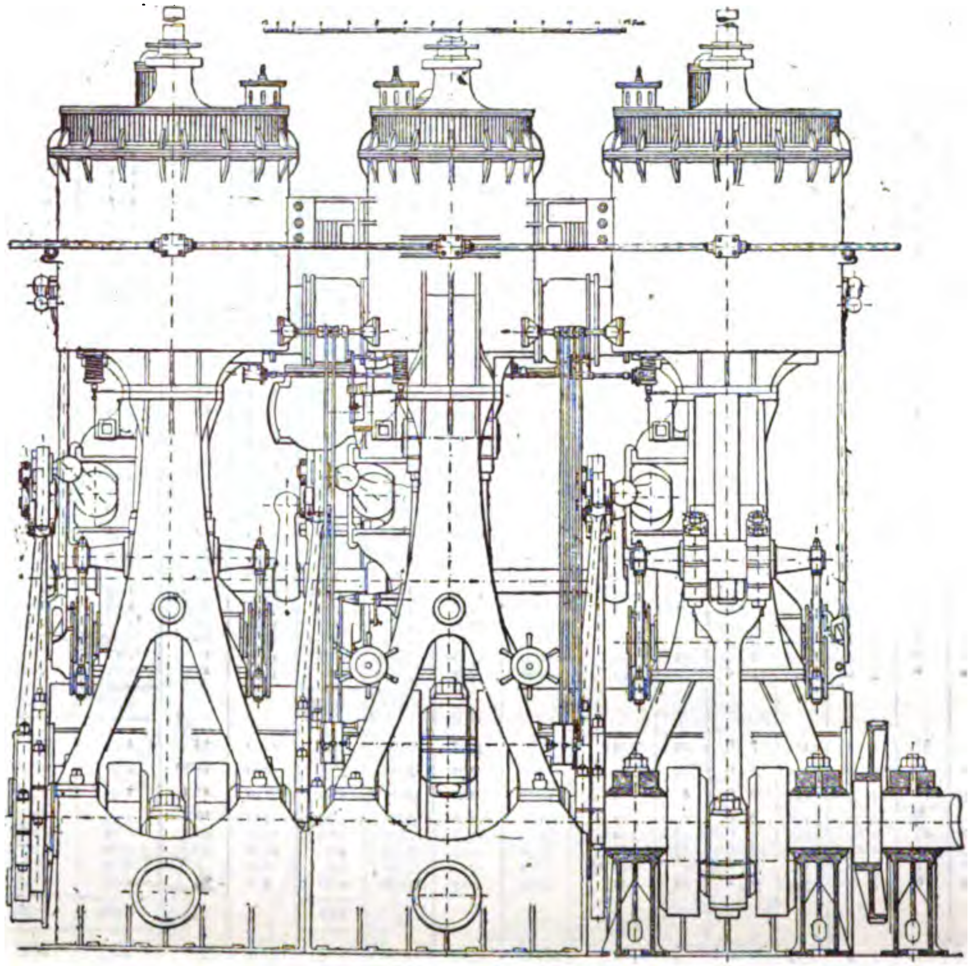
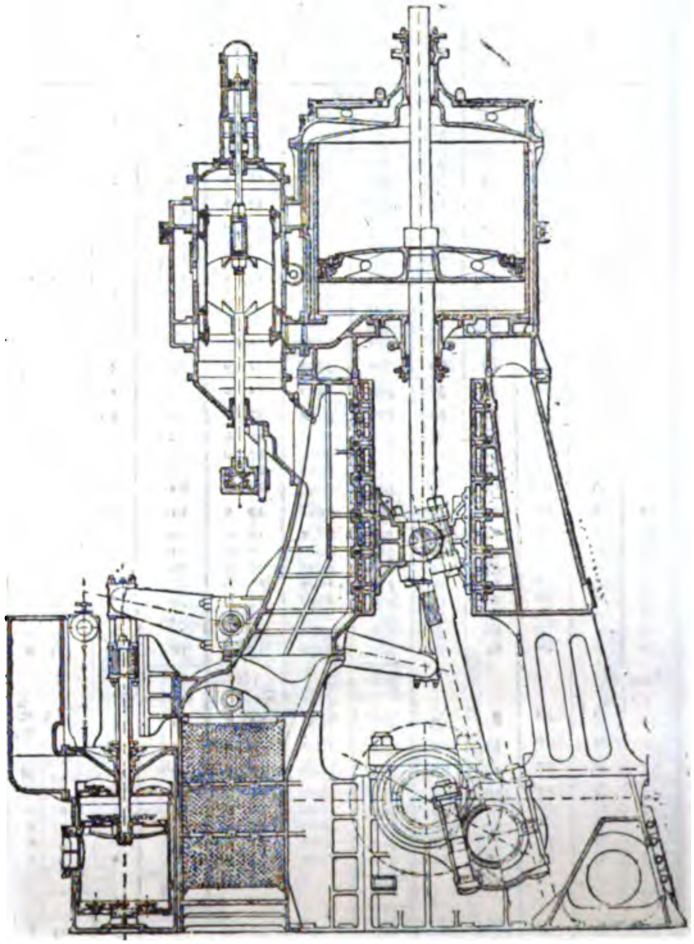


Fig. 2.



COMPOUND ENGINES OF THE SS. "ARIZONA."

See Mr. F. C. Marshall's Paper "On the Progress and Development of the Marine Engine," page 128.

TABLE I.—*Average* CONSUMPTION OF COAL *per Indicated Horse-Power per Hour, by Steam Ships with Compound Engines in long sea voyages.*

(See Mr. F. C. MARSHALL's Paper "On the Progress and Development of the Marine Engine," page 128.)

ENGINES.								BOILERS.														PERFORMANCE.			
No.	Class.	Cylinders.			Piston Speed per Min.	Condensing Surface.	Diameter of Screw Propeller	Working Press. above Atm.	Number of Boilers.	Shell.		Furnaces.		Tubes.			Total Fire-Grate Area.	Heating Surface.			Heating Surface per I.H.P.	Indicated Horse Power.	Coal Consumptn.		Heating Surface per lb. of coal per hour.
		Diam.		Stroke.						Diameter.	Length.	Total No.	Diameter.	Total No.	Length.	Outside Diam.		Tubes.	Furnaces, &c.	Total.			In 24 Hours.	Per I.H.P. per Hour.	
		High Press.	Low Press.																						
		In.	In.	In.	Ft.	Sq. Ft.	Ft. In.	Lbs.		Ft. In.	Ft. In.		Ft. In.		Ft. In.	In.	Sq. Ft.	Sq. Ft.	Sq. Ft.	Sq. Ft.	Sq. Ft.	I.H.P.	Tons.	Lbs.	Sq. Ft.
1	A	34	61	45	450	2466	15 3	70	2	12 0	25 0	8	3 6	800	6 0	3	140	3688	528	4216	4·68	900	14·5	*1·50	3·12
2	A	42	80	48	552	...	...	72·5	2	13 6	18 6	...	...	...	...	...	...	...	...	6000	3·19	1881	32·25	1·60	1·993
3	A	35	70	48	400	2400	17 0	90	2	11 6	18 0	8	3 6	640	6 10	3½	160	3814	626	4440	3·7	1200	21	1·63	2·205
4	A	46	87	57	484	5000	19 0	80	3	12 3	18 6	12	3 9	1104	6 7	3¼	250	6420	1383	7803	3·545	2200	40	1·60	2·130
5	A	22	44	30	360	705	11 0	100	1	12 8	11 6	3	3 0	172	7 3	3¼	49·5	1060	342	1402	3·34	420	7·5	1·67	2·0
6	A	50	86	54	540	4865	17 6	72	4	{W13 4½ {H16 0¾	10 0¾	12	3 6	1024	7 0	3½	273	6530	1192	7722	2·88	2677	48	1·67	1·725
7	A	35	70	48	424	2000	17 0	90	2	9 6	18 6	8	3 6	608	6 10⅜	3½	150	3822	952	4774	3·97	1200	21·5	1·69	2·35
8	A	54	94	60	530	7420	18 3½	75	6	12 9	10 6	18	3 2	1308	7 6	3½	313	8983	1856	10839	4·9	2207	40·3	1·7	2·88
9	A	54	94	60	486	7422	18 0	82·5	6	12 9	10 6	18	3 2	1206	7 6	3½	324	8735	2605	11340	6·3	1801	32·8	1·7	3·705
10	A	30	58	39	400	1518	14 2	80	2	12 0	10 6	4	3 2	344	7 3	3¼	69·64	2120	488	2608	4	650	12	1·72	2·34
11	A	29	56	33	350	1250	13 3	70	2	11 0	10 6	4	3 0	316	7 0¼	3¼	66·0	1891	488	2379	4·74	500	9·5	1·76	2·09
12	A	34	66	42	406	1700	15 6	80	2	13 4	10 6	6	3 3	352	7 3	3½	107·25	2708	766	3474	3·975	875	16·5	1·76	2·27
13	A	36	68	42	434	1821	16 3	77	2	14 4½	10 3	0	3 4	460	7 0	3½	110	2950	764	3714	4·34	854	16·75	1·763	2·46
14	A	54	97	60	480	7427	18 10½	70	6	15 10½	10 0	18	3 2	1314	7 6	3½	329	9198	1847	11045	5·52	2000	38·5	1·80	3·065
15	A	51	88	60	590	5000	17 6	75	4	{W15 6 {H18 6	10 9	12	4 2	1224	7 0	3½	332·5	7850	1398	9248	3·365	2745	54	1·83	1·839
16	A	28	53	38	380	1560	14 0	75	2	12 1	9 5	4	3 3	328	7 0	3½	78	2050	383	2433	4·34	560	11	1·84	2·36
17	A	50	86	54	540	5500	17 6	70	4	{W13 8 {H17 3	10 0	12	3 6	1016	7 0	3½	273	6303	1132	7525	3·105	2422	48	1·85	1·647
18	A	38	70	48	416	2600	17 9	80	...	...	...	...	...	...	...	..	65	...	...	4864	4·18	1160	23	1·85	2·26
19	A	35	70	48	408	2005	17 0	90	2	11 6	18 6	8	3 5	616	6 10⅜	3½	150	3872	954	4826	4·39	1099	22	1·87	2·35
20	A	35	70	48	440	2000	20 9	90	2	10 11	18 6	8	3 3	544	6 9	3½	136	3384	1012	4396	3·875	1135	23	1·89	2·05
21	A	34½	64	42	500	1647	15 4	80	2	9 6	13 0	8	2 8	368	6 9	3½	106	2332	618	2950	3·35	880	18	1·90	1·762
22	A	48	84	60	550	4468	19 0	70	3	{W11 0 {H14 3	16 6	18	3 2	1140	6 9	3½	340	7153	1047	8200	3·56	2300	47	1·90	1·873
23	A	50	86	54	510	4842	17 9	70	6	11 3¼	9 10	18	3 0	1188	7 0	3½	310	7603	2236	9839	4·44	2213	43·5	1·90	2·34
24	A	54	94	60	441	7420	17 9	70	6	12 9	10 6	18	3 2	1326	7 6	3½	312	9149	2601	11750	4·9	2400	48·9	1·90	2·58
25	A	56	97	54	504	5000	18 6	70	6	13 0	10 3	18	3 3	1062	7 3	3½	292	6913	1302	8215	3·282	2500	51·9	1·93	1·70
26	A	30	60	36	372	1600	13 0	90	2	11 3	9 7	6	3 2½	360	6 8	3½	115	2230	523	2753	4·59	600	12·5	1·945	2·36
27	A	36	70	45	560	2900	13 0	75	2	13 0	14 0	12	3 1	912	5 4	3	166	3884	738	4622	2·88	1600	32	†2·0	1·44
28	A	36	64	36	450	2059	13 0	70	2	13 0	9 4	6	3 2	380	6 4	3¼	106	2272	582	2854	2·795	1020	22	†2·125	1·315
29	A	36	68	42	530	2500	13 0	70	2	14 0	11 0	6	3 6	408	7 0	3½	130	2876	586	3462	2·77	1250	29	†2·25	1·23
30	A	36	67	42	530	2400	13 0	70	2	14 0	11 0	6	3 6	...	7 0	3½	129	2866	585	3451	2·8	1230	28	†2·25	1·243
Mean					**467**			**77·4**													**3·917**			**1·828**	**2·178**
31	C	48	83	60	523	9000	23 6	70	8	{W14 4½ {H 9 0	19 10	32	3 3	2432	7 2	3½	624	15783	3321	19104	3·9	4900	93	1·77	2·2
32	B	26	58	45	444	1700	15 0	80	2	13 4	9 6	6	3 0	472	6 6	3¼	99	2566	594	3160	3·85	820	16·75	1·90	2·026
33	B	27	56	52	395	1730	15 9	80	1	{W12 0 {H14 2	24 0	6	3 4	284	9 0	4	102	2675	569	3244	4·45	730	15·1	1·92	2·32
34	B	27	56	52	412	1650	15 9	75	1	...	...	6	3 4	296	9 0	4	102	2750	820	3570	4·63	771	16	1·93	2·4
35	C	28	60	54	504	4100	20 0	90	3	11 6	17 6	18	2 10	1116	6 6	3¼	300	6165	1235	7400	3·89	1900	40	1·96	1·986
36	C	28	60	54	522	4100	20 0	80	3	11 6	17 6	18	2 10	1116	6 6	3¼	302	6171	1243	7413	4·0	1850	40	2·01	1·95
37	C	16	34	30	360	768	12 6	68	1	11 6	9 10	3	3 2	150	6 6	4	47·25	1004	346	1350	5·0	270	7	2·25	2·22
38	C	26	52	42	336	2400	17 3	70	2	10 0	17 0	8	3 1	544	6 1	3½	132	3033	617	3650	4·06	900	24	2·47	1·641
Mean					**437**			**76·6**		W=Wdth H=Hght.											**4·22**			**2·026**	**2·096**
39	D	62	{90 {90	66	605		21 0	90	17	13 6	{six 18 0 {one 10 0	39	3 3	2522	7 0	3½	780	16200	3300	19500	3·09	6300	137	2·035	1·52

Class A—Compound Engines with one High and one Low-pressure vertical Cylinder, working two cranks at right angles.

FIG. 3.

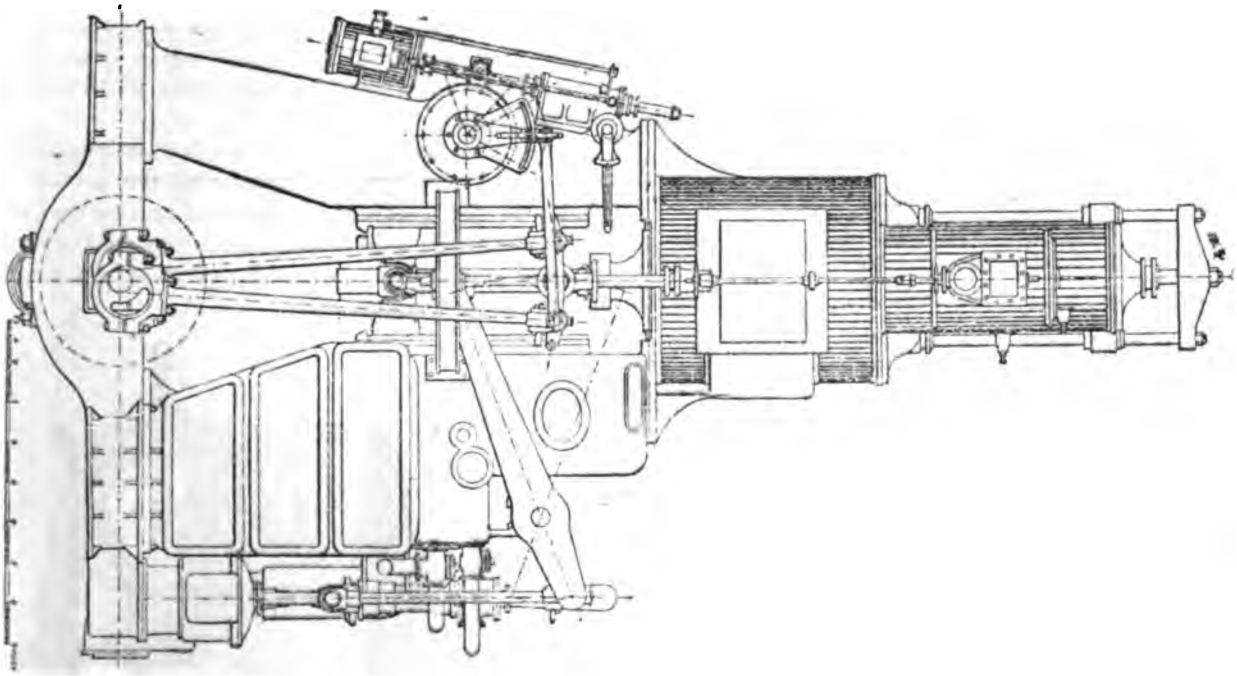
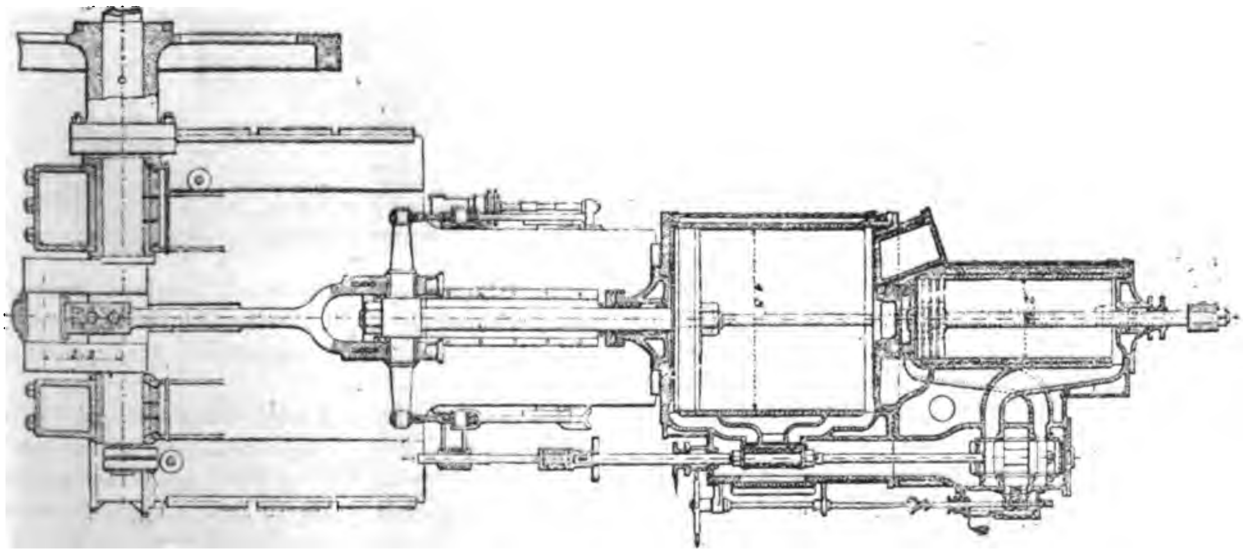


FIG. 4



TANDEM COMPOUND MARINE ENGINE.

See Mr. F. C. Marshall's Paper "On the Progress and Development of the Marine Engine," page 128.

Transatlantic steamships, has three cylinders, one high pressure between two low pressure, with an intermediate receiver, and working into one crankshaft, having three cranks placed at equal angles from each other.

This description of engine bids fair to become the favourite one for large powers; several are now at work and give unqualified satisfaction both as to economy of fuel and cheapness of maintenance. The *Arizona*, of the Guion line, one of the first constructed on the plan, has worked so well hitherto that her owners have since ordered others of greater power of the same description. The *Servia* also, now being finished for the Cunard line, has engines of this kind, (Figs. 1 and 2) with cylinders one of 72 in. and two of 100 in. diameter, and 6½ ft. stroke. Compared with the triple tandem engines of the *City of Rome*, these have only half the number of cylinders, pistons, valves, valve rods, and appurtenances to get out of order and keep in repair; while the balance of strains on the main shafting and crank-pins can be readily equalized by the adjustment of the cut-off of steam.

These three great types of compound engines may be placed as follows, in the order of their general acceptance by the shipowning community.

1. The two-cylinder intermediate receiver compound engine, having cranks at right angles.
2. The Woolf engine in the tandem form, having generally the high pressure and low pressure cylinders in line with each other, but occasionally alongside, and always communicating their power to one crank. Such a pair of engines is used sometimes singly (Figs. 3 and 4), oftener two pairs together (Figs 5 and 6), working side by side to cranks at right angles; recently three pairs together, working to cranks placed 120 deg. apart. The system affords the opportunity of adding yet more engines to the same propeller to an indefinite extent.
3. The three-cylinder intermediate receiver compound engine with one high and two low pressure cylinders, the steam passing from the high pressure cylinder into the receiver, and thence into the two low pressure cylinders respectively. The cranks are placed at equal angles apart round the crankshaft, so as to balance the forces exerted upon the shaft.

These three types may be said to embrace all the engines now being manufactured in this country for the propulsion of steam vessels by the screw propeller. In their leading principles they also embrace nearly all paddle engines now being built, whether the cylinders be oscillating, fixed vertically, or inclined to the shaft.

The compound engine in fact, in one of these three forms, may now be said to be universally adopted in this country; and the question of the relative value of simple expansion in one cylinder, and of compound expansion in two or more cylinders, which agitated the minds of some of our leading engineers ten years ago, is now practically solved in favour of the latter.

(*To be continued.*)

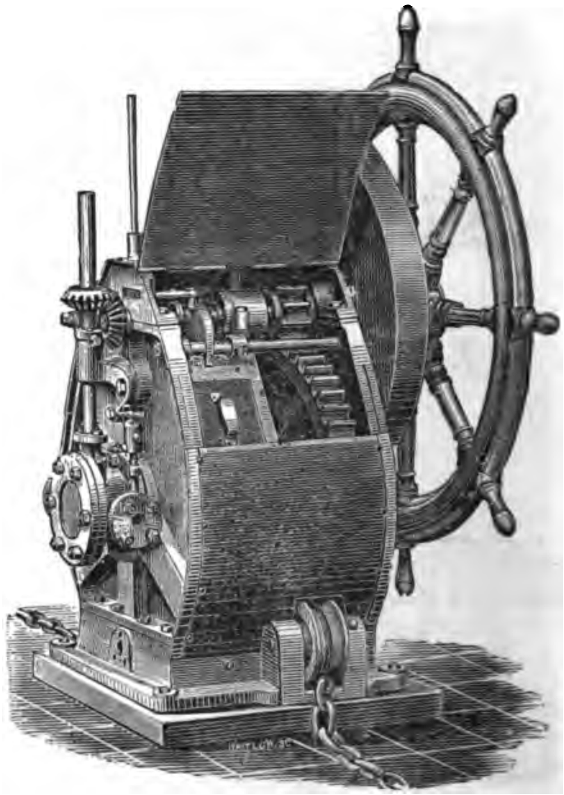
"THE STEAM QUARTER-MASTER."

As the above title implies, the quarter-master's duty is rapidly being usurped by steam, and there is no doubt that in rough and heavy weather the prompt and powerful action of steam steering gear is infinitely more reliable and effective than the sinews of many quarter-masters. The above title has been adopted by Messrs. Higginson & Co., of Liverpool, for their steam steering gear, which has special points of value.

It is arranged for steering by hand as well as by steam,—one motion only (without tools of any kind) being all that is necessary to make the change. Moving a lever, by hand, forward, will make it "hand power,"—moving the lever backward will make it "steam power."

The "Steam Quarter-master" is particularly well adapted for bridge steering, and in a few cases has been planted on the flying bridge itself with the greatest satisfaction: it is considered best, however, to fit the gear for steering from wheel-house and upper bridge as well, which last can be done at small additional cost. Its compactness brings it within range of all who wish for a combination gear (hand and steam), and will go easily into wheel houses already built on running vessels.

The valve connections are worked automatically, and are highly sensitive, regulating the amount of helm to the greatest nicety; and putting the tiller from amidships to hard over in the remarkably short time of 5 seconds, a point of the greatest importance when danger is imminent.



The "Steam Quarter-master" develops immense power without the slightest vibration, on account of all its movements being rotary—no dead points to overcome.

It is finished off with a neat brass-mounted cover, giving it a very presentable appearance, at the same time covering up all working parts, and so reducing to a minimum all risk to life or limb, a most important feature in these days of the Employers' Liability Act.

A "Steam Quarter-master" can be seen any day under steam at the Engineering works of Messrs Smurthwaite, Armstrong, & Co., Gun Lane, Limehouse, London, E.

FIG. 5.

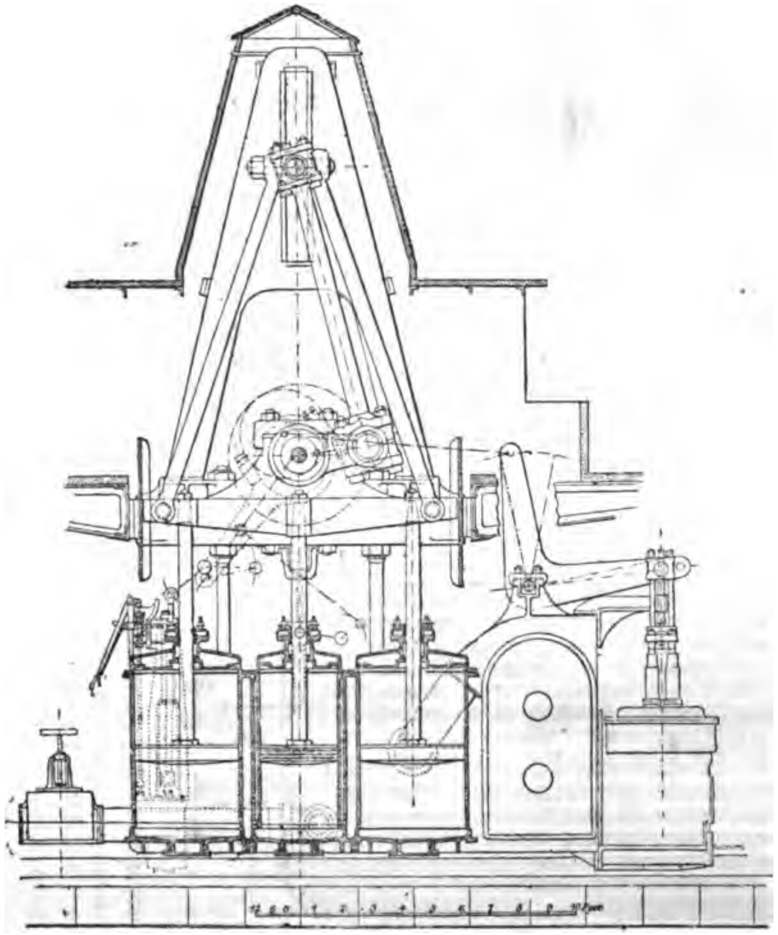
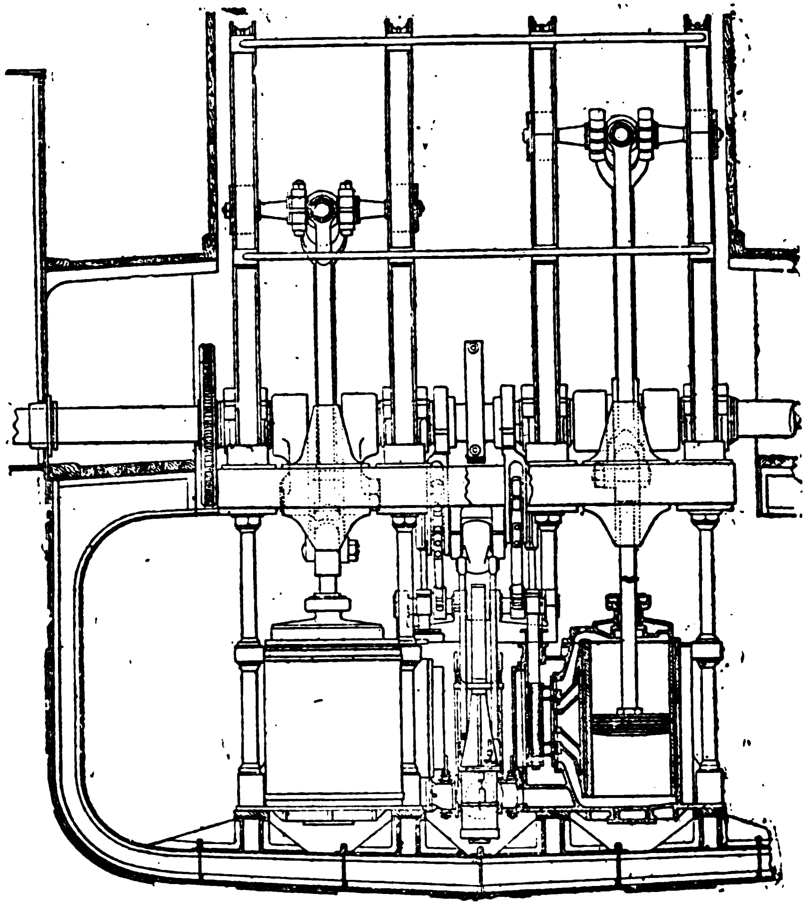


FIG. 6.



THREE-CYLINDER COMPOUND PADDLE ENGINES.

See Mr. F. C. Marshall's Paper "On the Progress and Development of the Marine Engine," page 128.

Messrs. Higginson & Co., Mersey Street, Liverpool, are the patentees and sole manufacturers, and we are glad to know that their invention has been well patronized since its introduction, now eighteen months ago,—having the seventy-fifth order now in hand in this remarkably short period.

ANTI-CORROSIVE AND ANTI-FOULING COMPOSITIONS FOR SHIPS' BOTTOMS.

THE value of a thoroughly good anti-fouling composition can hardly be over-estimated.

The keen competition which exists at the present day among the various shipping companies to obtain the highest rate of speed, renders everything that helps in that direction of importance to their interests, to say nothing of the benefits to be derived from the diminished cost of repairs, and the prevention of unprofitable delays in dock for cleaning purposes.

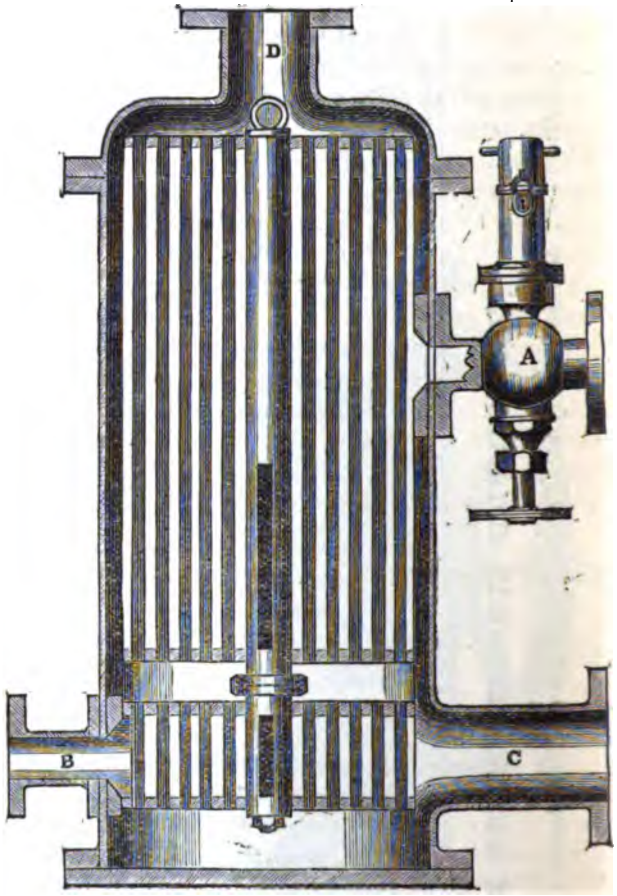
A good practical protective coating for iron ships' bottoms against corrosion and fouling has long been sought after, but few of those brought forward from time to time have been able to stand the test of a long stay in a fouling harbour; others, again, while effective in one particular, have been proved to exercise an injurious action upon the iron plates.

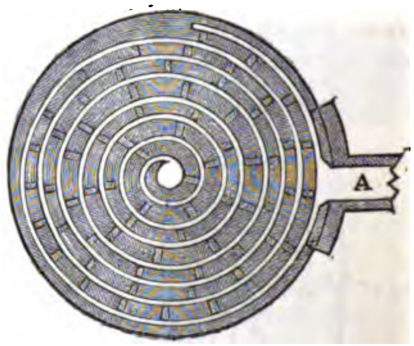
What is really required in a good composition for ships' bottoms is—First, a protective coating which shall be a certain prevention against corrosion in any form, but at the same time not act injuriously itself on the iron plates; and secondly, a coating on which nothing in the shape of animal or vegetable matter can adhere or live.

Since shipowners are at the present time at their wits end to know what to employ on their ships to prevent corrosion and fouling, having tried all sorts of compositions, each of which, as it has been brought out, has had promised for it the desired result, but which, in most instances, has failed in the test. We shall be glad to publish the experience of our practical mariner friends on the subject for their information.

FRESH DISTILLED WATER AT SEA.

IN our last issue we gave a brief notice of a fresh water distilling apparatus, invented by Mr. T. J. Rayner, and of which Messrs. Suffield, Railway Copper Works, Commercial-road, London, E., are the manufacturers. We now append the promised illustrations, viz., a vertical section, and sectional plan of the apparatus. Steam enters at the valve *A*, and spreads from top to bottom of the volute, then travels round till it reaches the centre of the apparatus. The water of condensation passing down, enters the lower volute, becomes quite cold, and then flows out at the pipe *B*. The circulating water enters at the pipe *C*, spreads over the bottom, then passes up through the volutes, and makes its exit through the pipe *D*.





The valve *A* is a combined steam and safety valve; a relief valve is also placed on the cover when required, and so as to conform with the Board of Trade Regulations.

The apparatus is made entirely of copper and gun-metal, and the condensing surface being lined with block tin, there is no possibility of corrosion from salt water as is the case when *iron* is used. Now, for actual *results.* We find that one of the cattle steamers — the *Surrey* —belonging to the Atlantic Transport Co., Limited, was recently supplied with Mr. Rayner's patent distilling apparatus, of a size calculated to produce 4,000 gallons of fresh water per day; and the actual quantity turned out (as per the certificate of the chief engineer) averaged some 1,500 gallons daily in excess of the stipulated supply. Similarly satisfactory results have, we understand, been obtained from the working of the apparatus supplied to the s.s. *Spartan*, and to the steam-yacht *Pandora*. The very small space occupied by this, as compared with any other distilling apparatus, for the same purpose, is a great feature in its favour; for instance, to turn out 600 gallons per day, the size is but 1 ft. 3 in. high, and 6 in. diameter. We understand that Messrs. Suffield have numerous orders on hand for this distilling apparatus, which we have little doubt will receive that extensive patronage which we anticipated for it in our last.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Blencowe.—On July 27th, Messrs. G. T. Eltringham launched from their yard at the stone quay, South Shields, a screw steamer, 165 ft. by 26 and by 13 ft., for Messrs. Fisher, Renwick & Co., Newcastle. She was named the *Blencowe.* Her engines are to be put in by Messrs. J. P. Renoldson, and will be 70-horse power.

Bertie.—On July 27th Messrs. M. Pearse & Co. launched from their iron shipbuilding-yard at Stockton-on-Tees an iron screw steamer of the following dimensions, viz.:—Length between perpendiculars, 257 ft. 6 in.; beam, 34 ft. 6 in.; depth of hold to top of floors, 19 ft. 6 in. This vessel is about 1,700 tons gross register, and will carry about 2,350 tons dead weight. She is built for the highest class granted at Lloyd's, with break poop aft, in which is fitted a handsome saloon, with the usual accommodation; has water ballast in cellular bottom, and will be rigged as a two-masted schooner. She will be provided with engines on the direct-acting surface condensing principle of 140-horse power nominal, by Messrs. Blair & Co., of Stockton, four steam winches, and all the most recent and improved appliances for expeditiously loading and discharging cargoes, and for ventilation and other sanitary purposes. As she left the ways, she received the name of *Bertie* from Mrs. Trechmann, of Hartlepool.

Sharon.—On July 27th Messrs. Turnbull & Son launched from Whitehall Dockyard, Whitby, a screw steamer, of the following dimensions:—Length, 240 ft.; breadth, 34 ft.; depth, 17 ft. 9 in.; deadweight capacity, about 1,950 tons. The vessel will be fitted with engines of 130-horse power, by Richardson & Sons, of Hartlepool, and has been built to the order of Messrs. Robinson & Rowland, of Whitby, for the Black Sea trade, and on leaving the ways was named the *Sharon* by Mrs. Rowland.

Gravina.—On July 27th, at the Thames Ironworks, Blackwall, the launch of the royal Spanish cruiser *Gravina* was performed in the presence of a large number of Spaniards resident in England. The Bishop of Avila blessed the ship shortly before it left the dock, and Senora Ocarna then performed the ceremony of christening, and the vessel floated into the dock. The Spanish Government, it appears, has given the order for the building of two powerful corvettes, the first of which, the *Gravina*, is of the following dimensions:—Length, 210 ft.; breadth, 32 ft.; depth, 16½ ft.; burthen, 1,039 tons; armament, three 6-inch (4-ton) breech-loading new type Armstrong guns; and engines of 1,500-horse power. The other vessel, the *Velasco*, is in a forward state, and will probably be launched next month.

Inchrona.—On July 27th a steamer of about 3,400 tons deadweight was launched from Messrs. C. Mitchell & Co.'s yard, Low Walker, for Messrs. Hamilton, Fraser & Co., of Liverpool. She was named the *Inchrona*, is intended for the general trade, and is to be fitted up by Messrs. R. & W. Hawthorn, Newcastle, with engines of about 300 nominal horse-power.

Blagdon.—On 28th July there was launched from the iron shipbuilding yard of Messrs. Hodgson & Soulsby, Cowpen Quay, an iron screw steamer, built to the order of Messrs. Robert Bell & Co., of Blyth. Her dimensions are:—Length, 292 ft.; length between perpendiculars, 285 ft.; breadth, extreme, 36 ft.; depth, moulded, 25 ft. 11½ in.; and depth of hold, 24 ft.; and to carry 3,000 tons dead weight. She will be engined by Messrs. R. & W. Hawthorn, of Newcastle, with engines of about 200 nominal horse-power. She was christened the *Blagdon*, by Miss Bella Bell, daughter of Mr. Robert Bell, the principal owner.

Talley Abbey.—On July 28th Messrs. Irvine & Co., of West Hartlepool, launched an iron screw-steamer, built for the firm of Pyman, Watson & Co., of Cardiff, and designed for the Bilbao trade. She will carry 1,300 tons dead weight, and is 215 ft. in length, her beam being 31 ft. 2 in., and her depth of hold about 15 ft. Her engines are 100-horse power, by Messrs. Thomas Richardson & Sons, of the Middleton Ironworks, Hartlepool; and every appliance, including the cellular principle, has been furnished to render the vessel equal to the highest class. Miss Rosa Lee, of Sedgeley Park, Manchester, performed the christening ceremony, the name given to the steamer being *Talley Abbey*.

Lancaster.—A screw-steamer, named the *Lancaster*, was, on July 30th, launched from the Jarrow yard of Palmer's Shipbuilding and Iron Company (Limited). The vessel is 262 ft. long, 35 ft. broad, and 23½ ft. deep. She will be fitted with a pair of compound surface-condensing engines of 180-horse power nominal. The carrying capacity (deadweight of the steamer, which is intended for the general trade) will be 2,800 tons. She has been built to the order of the Lancaster Steamship Company (Limited), Liverpool, of which Mr. Gilbert M. Steeves is manager, and is the first of a new projected line of steamers.

Pawnee.—A screw-steamer of 950 tons, named the *Pawnee*, was launched on July 30th by Messrs. T. Royden & Sons, Queen's Dock, Liverpool. Her length is 277 ft. 6 in.; breadth, 34 ft. 6 in.; and depth of hold, 25 ft. 4 in. She has been built for the Mediterranean and New York Steam Shipping Company. The *Pawnee*, which is one of three steamers building for the same trade, will be commanded by Captain Clayton.

Regina.—Messrs. Short Brothers launched on July 30th from their yard at Pallion, a screw steamer, built to the order of Messrs. Taylor & Sanderson, of Sunderland, of the following dimensions:—Length over all, 304 ft.; length between perpendiculars, 290 ft.; breadth, 38 ft.; and 29 ft. depth of hold, with a dead weight carrying capacity of 3,100 tons. The vessel has been built on the awning deck principle, to class 100 A 1 at Lloyd's, and has been built under special survey. She was named the *Regina.*

St. David.—On July 30th at the works of Messrs. Walker & Co., at Deptford Green Dock, the screw steamer *St. David*, which has been built for Count Raffo, an Italian Shipowner, and which is intended for the Mediterranean trade, was launched. The dimensions of the ship are:—Length, 150 ft. between perpendiculars; breadth, 20 ft.; and depth 13 ft.; while her draught of water is 10 ft. Her engines are compound service condensing, to indicate 300-horse power, and her speed is 10 knots loaded. The vessel is schooner-rigged, with two pole masts and a complete outfit of fore-and-aft canvas, and is registered 100 A 1 at Lloyd's.

Handel.—On July 30th a large steamer was launched at Messrs. A. Leslie & Co.'s yard, Hebburn, for the Liverpool and Brazil trade. She was named the *Handel*.

Edda.—On August 8th , from the yard of Messrs. S. P. Austin & Son, Wear Dock, Sunderland, was launched an iron screw steamer, built to the order of Messrs. J. T. Salvesen & Co., Grangemouth, and under the superintendence of Mr. D. Marshall, Consulting Engineer, Edinburgh, of the following dimensions :—Length over all, 223 ft. 6 in.; extreme breadth, 31 ft.; depth in hold, 15 ft. 2 in.; gross tonnage, 945; nett tonnage, 634. Constructed with long break, short full poop over cabin, bridge-house, and topgallant forecastle, iron decks, cellular double bottom for water ballast. She will be fitted with compound surface-condensing engines by Mr. John Dickenson, of 100-horse power nominal, steam windlass and steam winches. As she left the ways she was named the *Edda*, by Miss Sybil M. Austin.

Cachapoal.—A large screw steamship, built by Messrs. Laird Brothers to the order of the Compania Sud Americano deVapores, through their London representatives, Messrs. B. F. Smith & Co., was launched from the Birkenhead Ironworks on August 9th, and named the *Cachapoal*, the ceremony of christening being performed by Mrs. G. Smith. The steamer is intended to be employed in the company's service on the west coast of South America; and to meet the special requirements of the trade, and secure protection from tropical heat and perfect ventilation, the sides between main and spar decks have been left open, the spar deck being supported on stanchions, and the whole of the accommodation for first-class passengers and officers provided in deckhouses on that deck under cover of the shade deck. There will be accommodation for eighty first-class passengers. A number of third-class passengers will be provided for on the main deck, and there will be space for a large number of cattle. The *Cachapoal* has a clipper stem with female figurehead, and an elliptic stern, and will be rigged with three pole masts. She is fitted for water ballast, and will be provided with steam windlass, steam steering gear, and five steam winches; also with electric lighting apparatus. Her dimensions are:—Length, 320 ft.; beam, 40 ft.; depth in hold, 21 ft.; tonnage, O.M., 2,519 tons; and she will be fitted with a set of Messrs. Lairds' direct-acting inverted compound engines, having cylinders 45 in. and 80 in. in diameter and 4 ft. 6 in. stroke, supplied with steam at 75 lbs. pressure from four cylindrical boilers, and calculated to develope about 2,000-horse power, and to drive her at a high speed. Among those present were the Earl of Sefton and two of his sons; the Hon. Mr. Crowen; Mr. G. Smith, of London; Mr. Cockburn, Chilian Consul; Professor Wood; Mr. Thomas Drewsbury, the superintending engineer of the company; and a number of ladies and gentlemen.

Carlton Tower.—On August 10th there was launched from Messrs. Wigham Richardson & Co.'s, Neptune-yard, Newcastle, the *Carlton Tower*, a large iron screw-steamer, 300 ft. in length, 37 ft. beam, and 28½ ft. depth, to form one of the "Tower" line of steamers owned by Messrs. Stumour, Weston & Co., of London and Liverpool. As the steamer left the yard she was christened by Mrs. Christie, the wife of one of the builders. Immediately after launching, the *Carlton Tower* was taken under the Neptune sheer-legs to have her machinery put on board, which is of 300-horse power, and of the very latest type. She is fitted with Emerson Walker & Co.'s patent windlass, and will be fitted up in the most complete manner, to suit the American and Eastern trades.

Regent.—On August 10th Messrs. M. Pearse & Co. launched from their yard at Stockton an iron screw steamer of the following dimensions :—Length between perpendiculars, 200 ft.; breadth extreme, 30 ft.; depth of hold, 13 ft. 11 in. This vessel is about 841 tons gross register, and will carry about 1,100 tons deadweight. She is built of the highest class granted at Lloyd's, having break deck and hood aft, in which is fitted a saloon, with the usual accommodation; has water ballast in both holds, and will be rigged as a two-masted schooner. She will be provided with engines on the direct-acting surface condensing principle of 80-horse power nominal from the establishment of Messrs. Blair & Co., two steam winches and appliances for expeditiously loading and discharging cargoes, and for ventilation. As she left the ways she received the name of *Regent* by Mrs. Walker, of Middlesbrough.

Gwalia.—On August 11th, there was launched from the iron shipbuilding-yard of Messrs. Wm. Pickersgill & Sons, Southwick, Sunderland, an iron screw steamer, built to the order of Messrs. Hurley, Matthews, & Co., Cardiff, of the following dimensions :—Length, 240 ft.; breadth, 33 ft.; depth, 18 ft. The vessel has been so constructed as to be suitable for general trades with long quarter deck, bridge over engine and boiler space, cabin amid ships, wheel-house aft, topgallant forecastle, iron decks, cellular double bottom for water ballast the entire length of the vessel. She will be fitted with compound surface condensing engines by the North-Eastern Marine Engineering Company, with 29 in. and 56 in. and 36 in. stroke; also Emerson & Walker's patent windlass. The vessel is expected to carry a total dead weight of 1,900 tons. As she left the ways she was named the *Gwclia.*

Kenmore.—On August 11th an iron screw-steamer was launched from Messrs. Richardson, Duck & Co.'s yard at Stockton. The vessel, which was named the *Kenmore* by Miss W. J. Richardson, of Pott's Hall, is 352 ft. long, 41 ft. broad, and 29 ft. deep. She is 4,000 tons burden, and is classed A 1 at Lloyd's. Messrs. Blair & Co., of Stockton, will supply her with engines of 500-horse power nominal, and Emerson Walker & Co. the patent windlass. The *Kenmore* has been built to the order of Messrs. W. Johnson & Co., of Liverpool.

Lady Dalhousie.—On August 11th an iron screw steamer was launched from the shipbuilding-yard of Messrs. C. Mitchell & Co., Newcastle-on-Tyne. The ceremony of naming her the *Lady Dalhousie* was performed by Miss Mary C. Swan, of North Jesmond. She is brigantine-rigged, and is built to the highest class at Lloyd's, upon the bracket principle throughout, with continuous longitudinal keelsons connecting the outer and inner skins, and has three decks. The vessel is 295 ft. long over all. Her gross register will be about 2,000 tons, and she will be capable of carrying 3,000 tons of deadweight. The engines, which have been made by the Wallsend Slipway and Engineering Company, are of 235-horse power, and will be supplied with steam from two cylindrical multitubular boilers made of Landore Siemens steel, to be constructed for a working pressure of 80 lbs. per square inch. All the modern facilities for despatch in loading and unloading cargo, also in coaling, have been adopted in the vessel, which is supplied with Donkin & Nichol's patent combined hand and steam steering gear. She has been built to the order of Messrs. Adam Hamilton & Co., Greenock.

ON August 11th, there was launched from the yard of Messrs. Raylton Dixon & Co., an iron steamship, which they have built to the order of Messrs. Edward Harris & Co., and which will be, when completed, the largest steamer belonging to the port of Middlesbrough. The vessel is 279 ft. long over all. has a breadth of 37 ft. 3 in., and depth of hold of 24 ft. 6 in., which gives her a carrying capacity of about 3,000 tons dead weight. She will be fitted with engines of 150-horse power nominal, by Messrs. T. Richardson & Sons, of Hartlepool, Emerson Walker & Co.'s patent windlass, and will be in every way completed as a first-class merchant steamer, fitted for the Atlantic or any other ocean trade. This is the eighth vessel which has been built for Messrs. E. Harris and Co. by Messrs. R. Dixon & Co.

Cilurnum.—On August 12th there was launched an iron screw steamer, built for Messrs. Elliott, Lowrey & Dunford, Newcastle, by Messrs. C. S. Swan & Hunter, Wallsend, and of the following dimensions :—Length between perpendiculars, 295 ft.; breadth, 36 ft. 3 in.; depth of hold, 24 ft. 6 in.; tonnage (gross) 2,200 tons. She was named the *Cilurnum* by Miss Fanny Lowrey, and proceeds to St. Peters to receive her machinery of 250-horse power, which has been made by Messrs. R. & W. Hawthorn.

Supply.—An iron screw tank vessel, named the *Supply*, for her Majesty's service, intended for the Bermuda station, was launched on August 12th by Messrs. Laird Brothers. She is of 250 tons load displacement, and will be fitted with a set of vertical compound engines of 120 indicated horse power. She will be provided with powerful steam pumps, to deliver 80 or 100 tons of water per hour, also with steam fire-engines, and with towing appliances; and will, no doubt, prove a very useful vessel on the station.

City of Liverpool.—On August 12th Messrs. Wm. Doxford & Sons, Pallion, Sunderland, launched from their yard a screw steamer, built to the order of Messrs. W. H. Ross & Co., Liverpool. The vessel is 360 ft. long, by 41 ft. broad, and 31 ft. deep. It is intended for the American cargo and cattle trade, and is fitted for spar and main deck, to carry 1,635 head of cattle. Mrs. Hamilton, the wife of Captain Hamilton, the surveyor, christened the vessel the *City of Liverpool* as she left the ways. Her gross tonnage is 3,600 and her engines of 2,000 horse-power, and she is fitted with Emerson, Walker & Co's., Patent Brass Cone Brake Windlass.

Satellite.—On August 13, an addition was made to the Royal Navy by the launch of the screw composite sloop *Satellite*, at Sheerness Dockyard. The vessel has been built from designs prepared by the Naval Board of Construction, and although similar to the ill-fated ship *Doterel*, differs in several important particulars. The *Satellite* is 35 ft. longer and several feet wider in the beam than that ship, her total length being 200 ft. and her extreme breadth 38 ft. The depth in hold is 10 ft. 1½ inches, and height between decks 6 ft. 8 inches. She has a displacement of 1430 tons, being 300 tons more than the *Doterel*, and will carry eight 64-pound guns instead of six, as carried by the other. She is built of iron beams sheathed with teak, and has a steel deck 1½ inches thick for the protection of her engines and machinery, and the hatchways to the engine-room are fitted with shell-proof gratings and shutters, so that the most important part of the vessel will be protected from shell. The coal bunkers are situate below the steel deck between the engine-room and the ship's side, and every facility has been afforded for carrying large quantities of coal. In this respect the *Satellite* has great advantage over other composite vessels and will be able to make long voyages without calling at the different ports for coal. The powder magazines are placed in the fore part of the ship, the space between them being filled with water tanks and chain bickers. The engines of the *Satellite* are being made by Messrs. Humphrey & Tennant.

C. T. B.—On August 13th there was launched from the building-yard of Mr. Wm. Pickard, at Appledore, a schooner of the following dimensions, viz. :—Length of keel and forerake, 83 ft., breadth, 20 6-10 ft.; depth, 9 9-10 ft.; tonnage N.N. 91 tons; builder's measurement, 150 tons. She is named (*pro tem.*) *C. T. B.*, is the property of the builder, and, if not sold, is intended for the Newfoundland and general foreign trade.

Orchomene.—On August 13th Messrs. W. H. Potter & Son launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, a new iron sailing ship of the following dimensions, viz. :—Length, 250 ft.; beam, 37 ft. 9 in.; depth in hold, 23 ft.; tonnage B.M. 1,670 tons, ditto register, 1,550 tons, and of 2,550 tons deadweight capacity. The vessel was launched by Miss Moorecroft, and named the *Orchomene* by Miss Florence Norris. The *Orchomene* is the third of five vessels recently ordered by Messrs. Henry Fernie & Sons from Messrs. W. H. Potter & Son, the remaining two vessels each being of 3,100 tons burthen. The *Orchomene* is built to class 100 A at Lloyd's, and 20 years in red in the Liverpool Underwriter's book, her scantling being in excess of the requirements of both books. She is intended for the East Indian and Australian trades, and will be at once placed on the berth for Sydney. She will be commanded by Captain Findlay.

Isle of Arran.—On August 13th an iron screw steamer was launched from the yard of Messrs. T. and W. Smith, North Shields. The vessel has been built to the order of Messrs. Dixon, Robson & Co., of Newcastle, and is destined for the Spanish and coasting trades. Her dimensions are:—Length, 188 ft.; beam, 29 ft. 2 in.; depth, 13 ft. Her gross tonnage is 700 tons. Her engines, which are to be put in by Messrs. J. P. Rennoldson & Co., South Shields, will be 95-horse power. The vessel will also have the usual appliances for quick loading and despatch of cargo. The vessel was named the *Isle of Arran* by Miss Dixon, Blytheswood, Newcastle.

On August 15th there was launched from the building-yard of Messrs. R. & J. Evans & Co., Liverpool, a screw steamer, for the Steamship Herbert Company (Limited). The vessel has been built to the highest class at Lloyds, and is to carry about 220 tons deadweight, and is intended for the coasting trade. The machinery has been made by Messrs. De Winton & Co., Caernarvon.

Dartmore.—On August 15th Messrs. Richardson, Duck & Co. launched a steamer from their yard at South Stockton. Her dimensions are as follows :—Length over all, 268 ft.; length, b. p., 260 ft.; breadth extreme, 36 ft.; depth in hold, 18 ft. 2½ in.; tonnage, O.M., 1,643 tons. The vessel is classed 20 years in the Liverpool Registry, and has been built under special survey. She is built to the order of Messrs. William Johnson & Co., Liverpool, and was christened the *Dartmore.*

Java.—On August 15th there was launched from the shipbuilding yard of Messrs. Russell & Co., Cartsdyke, an iron sailing barque of 900 tons nett register, and of the following dimensions:—Length, 196 ft.; breadth, 32 ft. 6 in.; and depth of hold, 19 ft. 2 in. She has been built to the order of Messrs. Peter Denniston & Co., Glasgow, and is classed 100 A 1 at Lloyd's. As she left the ways she was named the *Java.*

Morro.—On August 22nd Messrs. Scott & Co., Shipbuilders, Cartsdrke, launched from their shipbuilding yard a twin-screw steamer of about 170 tons register, and of the following dimensions:—Length, 125 ft.; breadth, 23 ft.; depth, 15 ft. 6 in. to awning deck. She has been supplied by the builders with compound surface condensing engines—the diameter of cylinders being 15 and 30 in. respectively, and length of stroke 1 ft. 9 in. She is also furnished with one circular boiler and two corrugated furnaces. The steamer, which has been built to the order of the Pacific Steam Navigation Company, will be employed as a tender for the company's vessels at Panama. As she left the ways she was named the *Morro.* The vessel was taken to the Victoria Harbour to be fitted out and made ready for sea.

Billow.—On August 24 Messrs. Edwd. Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Messrs. Middleton & Co., of West Hartlepool. Her principal dimensions are :—Length, B.P., 257 ft. 6 in.; beam, extreme, 34 ft. 6 in; depth, moulded, 20 ft. 4½ in.; and deadweight carrying capacity about 2,400 tons. She is built to Lloyd's highest class, and has long quarter deck, bridge-house, and topgallant forecastle, divided into separate berths, with two beds in each; double bottom all fore and aft on the cellular principle; four hatches, arranged to meet the Board of Trade regulations as feeders for grain cargoes; four steam winches, patent windlass, Glover's patent steering gear, and all modern improvements, including Captain Donovan's patent boat lowering apparatus. Her decks, chart-house, engine and cabin skylights, and companions are of iron, and she will be rigged as a topsail schooner. The engines, of 160-horse power, will be supplied by Messrs. T. Richardson & Sons, of Hartlepool, and Patent Windlass by Emerson, Walker & Co., London. She is intended chiefly for the Indian and American trades. As the steamer left the ways she was christened the *Billow* by Mrs. Lawrence G. Bomford, of London.

LAUNCHES.—Scotch.

Thetford.—On July 23rd there was launched from the shipbuilding-yard of Messrs. R. Thompson & Sons, Southwick, an iron screw steamer, built to the order of C. Hutchinson, Esq., Rock Lodge, Roker, of the following dimensions, viz. :—Length, 240 ft.; breadth, 34 ft.; depth of hold, 17 ft. She has been constructed under Lloyd's special survey to class 100 A1, having a long quarter deck, with short full poop containing cabin, bridge house amidships with accommodation for engineers and petty officers, and for firemen and crew in topgallant forecastle. The main bridge, poop, and forecastle decks, together with masts and chart and wheelhouse, are all built of iron. She will be fitted throughout with all the latest improvements, and engines of 130 nominal horse-power, by Mr. George Clark, Southwick. As the vessel left the ways she was christened the *Thetford* by Mrs. Wilson, wife of Captain Wilson, who takes command.

Diamond (s).—On July 26th the *Diamond* (s), built by Mr. W. B. Thompson to the order of Mr. P. M. Duncan, Dundee, was launched from the Caledon Shipyard. This vessel, which has been classed A 1 at Lloyd's, is about 700 tons register, her measurements being—length, 218 ft.; breadth, 30 ft.; and depth of hold, 22½ ft. The steamer is fitted with two iron decks, the upper one sheathed with wood. Being built on the bracket system, with a double bottom extending the whole length of the ship, there is ample provision for water ballast. Compound surface-condensing engines of 120-horse power will be erected, and steam steering gear, steam winches, and all the most improved appliances for working the ship and accelerating the taking in and discharging of cargo will be provided. The christening ceremony was performed by Mrs. James Henderson.

Inisiativa.—On July 26th Messrs. Alexander Stephen & Son launched from their yard at Linthouse an iron screw steamer of about 2,200 tons, named the *Inisiativa*, and classed 100 A 1 at Lloyd's under special survey. This vessel has been built to the order of Carlo Raggio, Esq., of Genoa, and is of the most modern type, embracing all recent improvements, such as a double bottom throughout for water ballast on the cellular principle, steam steering gear, steam winches, and all best appliances for working cargo, &c. The engines and boilers (also made by Messrs. Stephen) were fitted on board before launching. The cylinders are 35 in. and 65 in. diameter by 42 in. stroke, supplied with steam from two ample boilers, having a working pressure of 80 lbs.

St. George.—On July 27th there was launched at Glasgow, from the yard of the London and Glasgow Engineering and Iron Shipbuilding Company (Limited), the pioneer of a new line of channel steamers to ply between that city and London, *via* Littlehampton, and touching at Belfast and Dublin. The line is to be managed in Glasgow by Messrs. Murray Brothers & Co. As the vessel left the ways she was named the *St. George* by Miss Hannah Murray, Myross, Pollokshields. The new vessel is a screw of between 600 and 700 tons, with all the necessary equipments for safety and speed, and has been specially constructed of light draught to suit her for entering the shallow harbour of Littlehampton at all stages of the tide. She is 190 ft. long, 29 ft. broad, and 13 ft. 3 in. deep (moulded); classed A 1 at Lloyd's, and built in accordance with Board of Trade requirements. The *St. George* will form the first of a fleet of four screw steamers now under construction in the same yard; and the second, to be named the *St. Andrew*, is pretty well advanced. She is to be schooner-rigged, and her engines, which are on the compound surface condensing principle, are to be over 100-horse power nominal. In addition to superior cargo space for the conveyance of general goods, the vessels forming the fleet will be able to accommodate a limited number of first-class passengers.

Waverley.—On July 28th the steamer *Waverley*, built by Messrs. Gourlay Brothers & Co. to the order of Messrs. Williamson, Milligan, & Co., Liverpool, was launched from the Camperdown Shipyard, Dundee. The christening ceremony was performed by Mrs. W. O. Dalgeish. The *Waverley* is the second largest steamer which has been built in Dundee, her gross tonnage being 3,080 tons, and her measurements—length, 340 ft.: breadth, 40 ft.; and depth of hold, 26 ft. 10½ in. The vessel has a double bottom, constructed on a longitudinal and bracket system, giving ample provision for water ballast, and she will be fitted with all the most improved appliances. She has been specially built as cargo boat of a superior class, and will be supplied with engines of 320-horse power to enable her to attain a high rate of speed. She is adapted for general trading, and is to be commanded by Alexander Burgess.

Operculum.—On July 30th Messrs. T. B. Seath & Co., the steam yacht builders of Glasgow, launched a small screw steamer, built to the order of Messrs. Luke Thomas & Co., of London, to class 100 A 1 at Lloyd's, special survey, and has been superintended, from the laying of the keel onwards, by her commander, Captain Walter Thomson, of Sunderland. She has been designed and fitted to meet the special requirements of her intended trade, local, &c., at Aden. The vessel was named the *Operculum.*

Christiansund.—On August 6th Messrs. Lobnitz & Co. launched from their shipbuilding yard at Renfrew an iron screw steamer 180 ft. by 25 ft. by 21 ft., 584 tons builders' measurement. She is intended for the trade between Denmark and Norway. The steamer has been built to Veritas highest class, and has been superintended by Captain Moller. The ceremony of naming the vessel *Christiansund* was performed by Mrs. Jack, wife of one of the partners of the builder's firm.

John Burbery.—On August 6th the Campbeltown Shipbuilding Company launched from their yard, French Point, Campbeltown, a screw steamer of about 400 tons. The vessel's dimensions are 145 ft. by 22 ft. by 9ft. 6in. She has been built under special survey, and is classed 100 A 1 at Lloyd's. As the vessel left the ways she was named the *John Burbery* by Miss Nettie Stove, of Lerwick, Shetland. This steamer has been built to the order of Captain Harley, Cardiff, for the coasting trade, and will be engined by Messrs. J. and T. Young, of Ayr.

Mid-Lothian.—On August 8th Messrs. Ramage and Ferguson, shipbuilders, Leith, launched from their yard a steel paddle steamer for the North British Railway Company's ferry goods traffic between Granton and Burntisland. This vessel is capable of carrying a complete train of forty loaded trucks across the Firth of Forth on six feet draught of water. The total length of the steamer is 270 ft., and the breadth 60 ft, while the total deck area is about 13,200 square feet, or nearly one-third of an acre. Compound engines of 600 horse-power nominal are supplied by Messrs. John Kay & Sons, Kirkcaldy. The steel used in the construction of the vessel has been supplied by Mr. Krupp, of Essen, and has been made by the Siemens-Martin process.

Ardgour.—On August 13th there was launched from the shipbuilding-yard of Messrs. Cunliffe and Dunlop, Port-Glasgow, a screw steamer of the following dimensions:—240 ft. by 37 ft. by 17 ft., and of 1,800 tons dead capacity. The steamer, which has been built to the order of Messrs. James Gardiner & Co., Glasgow, is intended for the Black Sea and general trade, and is fitted with water ballast on the cellular system. She is fitted with Bow and M'Lachlan's steam steering gear, Napier's patent steam capstan windlass, and other improvements. Her engines, which are of 130-horse power, will be supplied by the builders. As she left the ways she was named the *Ardgour*, the ceremony being performed by Miss Gardiner, Edinburgh.

Carthage.—On Aug. 24th a steamer named the *Carthage*, built for the Peninsular and Oriental Steam Navigation Company by Messrs. Caird & Co., was launched at Greenock. Her measurements are these:—Length, 430 ft.; breadth, 44 ft.; depth, 35 ft. (moulded); tonnage, 5,100, gross measurement. The ship is a duplicate of the *Rome*, launched by the same builders for the P. & O. Company on May 14th. The large centre-house amidships includes smoking-room and music-room, and from it entrance is got to the main saloon underneath. Forward and aft on each side of the vessel are the state rooms, bath rooms, &c. The vessel is to have a high rate of speed, and with that view very powerful engines are being prepared for her. They consist of four cylinders, having a stroke of 5 ft., with surface condenser, centrifugal and other pumps, &c. The crank shaft, which is in two pieces, weighs 30 tons. Steam will be supplied to the engines by six boilers. These are constructed of steel, and the working pressure will be about 90 lbs. Fuel will be admitted by no fewer than 30 furnaces, and the smoke will be carried away by two funnels. She will be fitted with four masts, and has short poop and forecastle. The best appliances for loading and discharging cargo, for pumping, for extinguishing fire, for steering, &c., will be put on board the *Carthage;* and the engines will have all the most recent patents for starting and reversing, and for controlling them in stormy weather. As the steamer glided into the water, she received her name from Mrs. Sutherland, wife of the chairman and managing director of the Peninsular and Oriental Steamship Company.

LAUNCH.—IRISH.

Coptic.—On August 10th there was witnessed in our harbour one of those interesting events which, by their frequent occurrence, have ceased to be novelties in Belfast—namely, the launch of a huge transatlantic steamship. The vessel which, at a quarter past ten o'clock, glided so gracefully from the slip in the presence of an immense number of spectators was the *Coptic.* She is, we believe, the eleventh of the celebrated vessels that compose the White Star Fleet, all of which were built on the Queen's Island, by Messrs. Harland & Wolff. The *Coptic* is sister ship to the *Arabic*, which on Monday morning left this harbour completely fitted out for sea, and since then has been lying at anchor in our lough, getting her compasses adjusted and having some painting, decoration, &c., executed on board of her. The dimensions of the *Coptic* are:—Length, 435 ft.; beam, 42 ft.; depth of hold, 32 ft.; and tonnage, 4,368. Both these screw steamers are built of steel; and, like the *Arabic*, will be supplied with engines, boilers, &c., rigged, and otherwise fitted out for sea by the eminent firm of builders named above. It may be stated that the engines are 3,000 horse power. Awaiting the launch yesterday morning were a great many persons, on both the Antrim and Down sides of the river. Immediately after the launch the *Coptic* was brought close over to the end of the Queens Quay, adjoining Abercorn Basin, and a numerous staff of workmen soon resumed their operations on board. With all possible dispatch she will be fitted out for sea.

LAUNCH.—FRENCH.

St. Jean.—On August 11th there was launched from the shipbuilding yard of Forges & Chantiers de la Méditerranée at Graville, near Havre, an iron screw steamer built for Messrs. Figueroa Le Roy & Co., and intended for Spanish ore trade. This vessel is the third built by the same firm for these owners. The dimensions are:—Length between perpendiculars, 220 ft.; breadth moulded, 29 ft. 6 in., depth moulded, 16 ft, 9 in.; tonnage gross registered, 1000 tons. She will carry about 1450 tons deadweight, and is classed at the highest class of Bureau Veritas, under special survey. She will be fitted with engines on the compound principle 400 indicated horse power, by the same firm at Havre. This vessel is fitted with double bottom for water ballast, three steam winches and rigged as a two masted schooner, the lower masts are iron. She was christened the *St. Jean*, by Mrs. Doumerc, of Paris.

TRIAL TRIPS.

Uppingham.—The s.s. *Uppingham*, which has been built by Messrs. Raylton Dixon & Co. to the order of E. Pembroke, Esq., Austin Friars, London, left the Middlesbrough dock on Wednesday afternoon, August 10th, for her trial trip. This handsome steamer is built on the spar-decked rule, her length over all being 300 ft., breadth 38 ft. 3 in., depth of hold 26 ft. 2 in. She is built on the new cellular bottom principle for water ballast throughout, has iron main and spar-decks, and latter covered with teak. Her gross tonnage is 2,203, and she will carry 3,530 tons on a draught of 24 ft. The cabins for accommodation of captain and a few passengers are below the spar-deck aft, the entrance to which is protected by a companion-house, and with a hood-aft for the protection of steering gear; officers and engineers are accommodated in 'tween decks amidships. Her engines, which are of 250-horse power, are by Messrs. J. Richardson & Sons, of Hartlepool, and she is fitted with Higginson's patent steam quartermaster and patent direct steam windlass by Emerson, Walker & Co., London, and all the latest improvements for a vessel of this size and class. A small party, consisting of the owner and friends, along with the builder, proceeded with her on her trial trip, which was very satisfactory (11 knots being attained in bad weather), and on the conclusion thereof she proceeded to Cardiff, where she will take a cargo direct for China.

Dalriada.—This screw steamer, lately launched by Messrs. John Fullerton & Co., Paisley, and built to the order of H. H. Smiley, Esq., of Larne, went down the Clyde on her official trial trip on August 20th, under the command of Captain M'Pherson. The *Dalriada* steamed the distance between Cloch and Cumbræ Lights at a speed of over 10 knots an hour, which was considered highly satisfactory by the owners, her carrying capacity being large in comparison with her engine power. The engines, which were supplied by Messrs. William King & Co., Dock Engine Works, Glasgow, worked during the whole trip in a most satisfactory manner.

M. Menatchy.—On August 13th the screw steamer *M. Menatchy*, built for Messrs. Katz Brothers, of Penang and Singapore, by Messrs. Mitchell, Low Walker, proceeded to sea to make her trial of her machinery, which is of 300-horse power, manufactured by the Wallsend Slipway and Engineering Company, and on her run to Newbiggin and back to the Tyne she made an average speed of 13 knots an hour.

Ecuador.—The screw steamer, *Ecuador*, of 1,920 tons, the second of two new vessels just completed by Messrs. Laird Brothers for the Pacific Steam Navigation Company, has made her official trial trip at the mouth of the Mersey, attaining a speed of about 12 knots, the engines indicating about 1,350-horse power.

Dorset.—The steamship *Dcrset*, the latest addition to the fleet of the Great Western Steamship Company (Limited), arrived at Avonmouth after a fine run of 67 hours from the Tyne, a distance of 745 miles. She has on board part of her cargo for New York, and has come to Avonmouth to complete her loading and to receive her passengers. She is a very fine specimen of naval architecture, and is fitted with all modern appliances. Her dimensions are:—Length, 331 ft.; breadth, 39 ft.; depth, 26½ ft. Her signal lights are carried in steel turrets. Her saloon, like the cabins of the *Devon*, *Somerset*, and *Cornwall*, is fitted with Hungarian ash panels, with rosewood mouldings and mahogany styles, but instead of the usual settees has revolving arm-chairs. The builders are Messrs. J. L. Thompson & Sons, of Sunderland. The engines, built by Mr. George Clark, of Sunderland, are massive, and all the parts of unusual strength; they worked during the whole trip with perfect smoothness, and developed a speed of 1,800-horse power. The cylinders are 40 in. and 76 in., with 48 in. stroke. The boilers are of Landore Siemens' steel, fitted with Martin's patent doors, and have been tested to the pressure of 160 lbs. to the square inch. During the passage she ran from the *Longship* light-ship to the one on the Welsh grounds, 160 miles, in 12 hours.

Edith (s.s.)—The screw steamer *Edith*, 900 tons burthen, had her trial trip last month. This vessel was the property of Messrs. Pyle & Co., London, and had been re-fitted and re-classed at Lloyd's by the Strand Slipway Company, and fitted with new engines and boilers by Messrs. Wilson, of the Monk-street Marine Engineering Works, Monkwearmouth. The dimensions of the engines are:—cylinders, 22 in. and 40 in. diameter by 30 in. stroke, with 1,500 feet of heating surface in the boiler, which carries a working pressure of 80 lbs. per square inch, and have been built to the order of the owners, under the inspection of Mr. W. A. Pile, of the firm of Pile & Co. The vessel proceeded as far north as Blyth, and steamed a mean speed of 10 knots, the engines working very smoothly. It is calculated she will steam 8½ knots average speed when loaded with 900 tons, on not exceeding 5½ tons per day of coal. Since the trial the vessel has been sold to Messrs. Powley, Thomas & Co., of Cardiff, this being the third vessel this young and enterprising firm have bought from this locality within a short time. Their previous purchases having been very successful, their shareholders were anxious that they should add another to the number. All parties were well represented: the company on board at the trial trip consisted of Messrs. Powley and Thomas, Mr. Powley and Mr. Pilling from Leeds, and other shareholders; Mr. W. A. Pile, Mr. Powell, engineer, Cardiff, representing the purchasers; Messrs. J. W. and F. Wilson, the engineers; Mr. J. Young, of Shields, and others.

Chateau Leoville.—The trial trip of the *Chateau Leoville*, the fourth steamer completed by the recently established Sunderland Shipbuilding Company, took place lately with results satisfactory to every one connected with the construction or with the ownership of the steamer. The first vessel built by the company was for the Avon Shipping Co., the second for a Liverpool firm, the third for one at Antwerp, and the fourth, the *Chateau Leoville*, for the Bordelaise Steam Shipping Company, which carries passengers and merchandise between Bordeaux and New York. For this trade the *Chateau Leoville* is intended. She is a fine specimen of modern marine architecture, built with flush wooden deck, fitted with three masts, schooner-rigged, and all the latest improvements for the steering of passenger steamers and the loading and unloading of cargo. Her dimensions are:—Length, 380 ft.; breadth, 41 ft.; depth of hold, 31 ft. She is calculated to carry about 4,000 tons, and so provide accommodation for 50 first-class and a number of second-class passengers. At ten o'clock a goodly company of ladies and gentlemen left the New Lock entrance on board the tug *Rescue* to be present at the trial of the engines, which have been built by the North-Eastern Marine Engineering Company (Limited). In a tour round the ship we found the main saloon was reached through a sort of comfortably furnished lounge, and down a flight of wide and well-lighted stairs. The saloon is between fifty and sixty feet in length. It runs to the stern bulkheads, and along its entire length are substantial mahogany dining-tables, with dark crimson velvet covered seatings. On either hand are the berths, likewise fitted with crimson velvet upholstery, and the beds with crimson and gold damask hangings. The partitions between the berths and the saloon are of a design novel to this part of the country. They look both handsome and substantial. The body is of polished walnut, with mahogany panels and rosewood frames. The panels are made diamond-shaped, the lines being about two inches apart, and in the centre of each is a cluster of carefully-carved fruit. The rails are likewise of rosewood, with massive silver-gilt mountings, and between each length is placed a handsome fluted column, in black and gold, with a carved and gilded capital. Near the floor is a row of long narrow ventilating panels of metal work, beautiful in design and colouring; and at the entrance end is the sideboard, a little gem, constructed to harmonize with the panels and other surroundings. The ceiling and other decorative work has been executed by Mr. George Tawse, of Blandford-street, in a renaissance style of architecture. The ceiling of the saloon is panelled and finished in enamel and tints of light blue, light pink and gold, while the panelling beneath the skylight is pleasingly relieved with simple designs in flowers. On the port end of the main saloon is that for the ladies, with bath-room, and sleeping compartments *en suite*, and separate apartments for the maids. The sleeping apartment is fitted with a library, and the berths with blue and gold hangings. The saloon is upholstered in blue velvet, with electro-plated lamp and fittings, the walls being handsomely panelled in harmony with the main saloon. The steward's pantry stands between the ladies' quarters and those of the steward and doctor, the doctor's consulting room, and a row of hot and cold water baths. Above the steward's pantry on deck is a comfortable smoke room, which is reached through the lounging room, the sides of which show a masterpiece of oak graining. The accommodation for the officers and other passengers are on deck amidships, while berths for 44 seamen are provided in the forecastle. The engine-room is exceptionally airy and well-lighted. The engines are 350 nominal horse power, the cylinders being 44 in. by 83 in. with 4 ft. stroke; 80 lbs. pressure, and fitted for variable expansions, and the two boilers are double ended, with six furnaces to each. We may as well here mention that during the trial the engines indicated 1,850-horse power, with 62 revolutions, and that the measured mile off Whitley was run against the wind in 4 min. 15 sec., or at the rate of fully 14 knots an hour. During the afternoon luncheon was served in the main saloon by Mr. W. B. Harrison, of Bridge-street, the arrangements being creditably carried out under the superintendence of Mr. Victor Vivas.

Correspondence.

[It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.—ED.]

"STATUS" OF MARINE ENGINEERS.

To the Editor of the MARINE ENGINEER.

SIR,—I think as a first step to the improvement of our position as suggested by "G. M." and others in these columns, we should put ourselves in communication with the Shipowners' Society and the Board of Trade, for as long as shipowners have to pay tonnage dues for all enclosed places aboard ship, there will be no improvement in the accommodation. For any improvement in wages, the best thing would be to form a Sea-going Engineers Association, having for one of its objects mutual improvement and exchange of ideas.

WAVE.

Sunderland, *August 8th*, 1881.

LAUNCH OF H.M.S. "CANADA."

ON Friday morning, August 26th, the *Canada*, corvette, which had been building at Portsmouth since July, 1879, was launched by the Crown Princess of Germany. The dockyard gates, thanks to the characteristic generosity of Admiral Foley, were thrown open to all comers, a few reserved booths at the bows and starboard side of the ship being alone retained for the privileged classes. The ships in the harbour displayed masthead flags; Royal Standards floated from the dockyard gates, the Semaphore, and the King's Stairs; and amid the bunting with which the dockyard was profusely embellished the Royal flags of England and Germany were conspicuously blended in honour of her who is at once Princess Royal of the one and Crown Princess of the other country, and who is cordially loved by the people of both. In fact, a great surprise awaited the majority of the spectators. Up to Thursday afternoon it was understood that the *Canada* would be launched by the Hon. Mrs. Foley, wife of the Admiral Superintendent of the Dockyard; but as the sister ship, the *Cordelia*, is to be launched in about six weeks' time, it was determined to take advantage of the Crown Princess of Germany's presence in the Isle of Wight to ask Her Imperial Highness to perform the ceremony on the present occasion, a request which was at once graciously complied with. The Princess, with the Princesses Victoria, Sophie, and Margaret of Prussia, and attended by the Countess Kalckreuth, Mdlle. Bussard, Lady Cowley, and Count Seckendorff, left Norris Castle in the Royal yacht *Alberta*, Captain Balliston, at half-past 10, and on arriving at the dockyard the party were driven to the ship, where a reserved space was prepared for them at the stem of the ship. Among the ladies and gentlemen admitted to the enclosure were Prince and Princess Edward of Saxe-Weimar and the principal officers of the district staff, Admiral and Mrs. Foley, Admiral Sir Thomas Pasley, Admiral Chads, Admiral Lethbridge, Captain Sir Michael Culme-Seymour and Lady Seymour, and the Mayor of Portsmouth and Miss Pink. The lanyards which kept the weights poised over the dogshores were led across an ornamental pedestal in front of the Princess, while the customary bottle of wine, concealed in a mass of cut flowers, was suspended over the vicious-looking snout of the ship, the beautifully hollowed entrance of which, moulded as it is, according to the suggestions of the late Mr. Froude, was itself a picture of gracefulness. The *Canada* is scarcely so far advanced as are most ships when launched. In consequence of the state of transition in which naval armaments are at the present time, her gun-ports, alike at the sides and at the fore and after ends, remain to be cut, and her gunnery gear to be placed in position. As, however, the slip was wanted for the laying down of the *Calliope*, and the fittings could be carried out as well in dock as anywhere else, her launching was resolved upon. At half-past 11 the naval church service was read by the Rev. George G. W. Clemenger, chaplain of the yard, after which the hammers of the shipwrights began to play upon the blocks. Ten minutes afterwards Admiral Foley handed the bottle to the Princess, who performed the christening ceremony, by allowing it to dash itself against the prow, and presently afterwards the ship was deemed ready to take the water. The Princess then, by means of an ornamental mallet and chisel severed the lanyards upon the pedestal, and the dogshores were heard to fall with a sullen bang. The corvette, however, did not move at once. A few more blocks were removed, and, after a little persuasion on the part of four hydraulic rams placed under the bows, the *Canada* slid down the ways at a quarter to 12. She is the first vessel constructed at Portsmouth in which steel has been largely introduced, and was built by Mr. W. Malpas, foreman of the yard, under the direction of Mr. J. C. Froyne, the senior constructor, by whom the launching operations were conducted. After the launch the Princess Royal and party lunched with Admiral Foley, and returned to Norris Castle in the *Alberta* at half-past 2 o'clock.

The *Canada* belongs to the *Comus* class of corvettes, which the Admiralty evidently regard as the best form of unarmoured cruisers. There are at the present time no fewer than seven of the kind either in commission or preparing for sea, and of these it may be remarked as significant of their merits that two—the *Cleopatra* and the *Carysfort*—are with the detached squadron under the Earl of Clanwilliam; that two others, the *Curaçoa* and the *Comus*, are upon the China station; and that another, the *Champion*, is in the Pacific. The *Cordelia* is being constructed in the slip adjoining the one from which the *Canada* was launched, while a ninth and tenth, the *Calypso* and the *Calliope*, are about to be laid down at Chatham and Portsmouth. Nor is it difficult to conceive why ships of the class have been received with favour by successive Boards. When it was known that vessels of the *Wampanoag* class were being vigorously constructed in the United States, and that the American Government would probably take advantage, on the first opportunity, of their exclusion from the Declaration of Paris by which the maritime Powers of Europe were bound, and make war, *a la Alabama*, upon the commerce of England, it was generally felt that this country could not afford to allow her unarmoured vedette and patrol fleet to be surpassed by similar cruisers in the American Navy. The *Inconstant* and the *Shah*, frigates, of the length of 337 and 342 feet respectively, and having a load displacement of 5,780 and 6,050 tons, were accordingly built. It would be unjust to state that these ships have turned out failures, for both have performed excellent service in times of emergency, and one, the *Inconstant*, is at this moment the flagship of the Admiral commanding the Detached Squadron. It soon became apparent, however, that they were not exactly suited for the special purpose for which they were designed. As the present Civil Lord of the Admiralty remarked, "The designers were betrayed into an exaggeration of size from over-anxiety to combine in a single ship every quality with which an unarmoured vessel can possibly be endowed. They were to possess unrivalled speed, both under steam and under sail, and to be armed with such batteries of armour-piercing guns that it was hoped engagements might be fought even against armoured ships with some prospect of success. The attempt was ambitious, and not altogether unsuccessful, but they are now found to be too expensive for mere protection of commerce, and their guns would be useless against armoured ships of the present day." Exception may be, and has been, taken to the strictures of Sir Thomas Brassey; but one very significant and incontrovertible fact remains. Since the launch of the *Shah*, no unarmoured cruiser of like bulk has been added to the Navy List. The *Raleigh*, the *Active*, the *Boadicea*, and the *Volage* exhibit a descending scale of length and displacement, until we come to the *Comus*, the last of the series, which only transcends by 260 tons the displacement of the composite corvettes of the *Gem* class. In fact, the Constructive Department have differentiated the purposes of our men-of-war, and have abandoned the hopeless attempt to construct a perfect and universal ship. In the *Iris*, which is distinctively termed a "despatch vessel," everything has been sacrificed to speed, while the *Nelson* and the *Northampton* have been specially designated by the Controller of the Navy as examples of what he calls "our protecting or armour-clad cruisers," the business of which is not to take part in a close engagement, but "to roam over the seas and drive away those wasps, those unarmoured fast cruisers, which were to be brought to bear upon us by stopping our trade and preventing us carrying on that commerce in which we have always taken the foremost place all over the world."

As handy unarmoured cruisers, which can dispense with docking because of their coppered bottoms, and with steam and coal depôts to a very large extent, because of their enormous sail capacity, and which, consequently, may be employed as patrols and escorts upon distant stations, no class of vessels surpasses the corvettes of the *Comus* class; and of these the *Canada* may be regarded as the most efficient, since she combines within herself all the latest improvements and developments. Instead of the auxiliary stern rudder with which the *Comus* was fitted under the shaft, the *Canada* has been provided with a bow rudder, for use in case of the main rudder, which is made of wood, with iron shields, being carried away. The arrangement of this rudder, which is, however, merely experimental, and will not be fitted to the *Cordelia* until it has been tried at sea, is somewhat peculiar. It is placed in the centre line of the ship, just abaft the stem, or what is technically called the fore deadwood. When required, it is made to lower below the keel, and to be drawn up within a well when not needed; but, should the ship be driven into shallow water, and injury be likely to accrue from there being no time to hoist the rudder into the well, it is so adjusted that it can be instantly dropped into the sea. Another improvement has reference to the propeller. The other ships of the class are provided with a screw well, into which the propeller can be lifted when the ship is under canvas; but in the *Canada* the resistance of the screw in similar circumstances can be reduced to a *minimum* without the trouble of disconnecting it. The screw is simply turned so that the two blades are brought in a vertical position parallel with the sternpost, when, by means of Mr. Bevis's patent gear, which is worked from inside the ship, the blades are feathered and placed in a fore and aft direction. The armament of the *Canada* also differs from her sister ships. Instead of 14 guns, consisting of 7-inch and 64-pounders, she will carry 10 of the new 6-inch B.L.R. guns. She will also be fitted with gear for ejecting the Whitehead torpedo, ports being cut through on each side of the lower deck, in addition to a defensive armament comprising two Nordenfeldt guns, capable of being fired from six positions, a couple of Gatling guns, one 9 pounder field-gun, and a 7-pounder boat gun. In most other respects the *Canada* closely resembles the corvettes of her class. She measures 225 ft. between perpendiculars, 44 ft. 6 in. in extreme breadth, and 21 ft. 6 in. in depth of hold. Her estimated load draught forward is 17 ft., and aft 18 ft. 6 in., while her total displacement when fully equipped for sea is 2,383 tons. Her officers and crew will number 245, and while the normal quantity of coal which she will carry is 270 tons, she will be able, in case of pressing necessity, to stow as much as 370 tons. The transverse frames are formed of iron, but the rest of the material, such as the skin plating, transverse and other bulkheads, longitudinals, &c., are steel. The stern and body posts and ram are composed of solid brass forgings, while the rudder is made of oak. A novel feature in ships of this class is the 1½ in. steel shell-proof deck, which is placed 3 ft. 6 in. below the water-line, and extends over the whole length of the engines, boilers, and magazines, side plating, seven-eighths of an inch thick, being also fitted in wake of the deck and water-line. From the shell-proof deck up to the lower deck water-tight cellular spaces are fitted, so that, in the event of one being pierced by shell, the others will remain intact, and thus preserve the buoyancy of the ship. The spaces at the side are intended to be filled with coal, while the others will be appropriated to patent fuel or stores. This arrangement not only affords protection against shot, but localizes to a single, small compartment any leak arising from shells penetrating the side. Upper and lower coal bunkers are provided, and, as the latter may be emptied without interfering with the former, a strake of coal armour can be allowed to remain as long as possible in the neighbourhood of the water-line. Coffer dams are erected round the large hatchways to the engine-room, boilers, and stoke-holes, while the hatches themselves are protected by armour-shutters or bars, the result being that the spaces below are supposed to be completely protected from shell fire. The steel skin of the ship is cased in two thicknesses of wooden sheathing, upon which the copper is fastened. The engines, of which the propeller-shaft and the after part of the crank-shaft are already in place, are by Messrs. J. & G. Rennie, of London. They are to be of 2,300 indicated horse power, and are of the horizontal compound type, having four cylinders, each high-pressure cylinder being at the back of and working in conjunction with its respective low-pressure cylinder. Two of the cylinders are 36 in. in diameter, while the others are 64 in., the stroke being 2 ft. 6 in. Steam will be supplied by six boilers, having a heating surface of about 6,600 square feet. The general arrangement is in other respects very similar to that in the *Bacchante* and *Boadicea*, by the same makers. The funnels will be made to lower, a new feature in this class of vessel.

Notes and Novelties.

A WOODEN ship has recently been built and launched at Blyth—a rare circumstance. Iron ships now rule the market, and a wooden ship being built is now quite a curiosity.

A SEA MESSENGER.—During the recent cruise of the Reserve Squadron, a sea messenger, invented by Mr. Julius Vandenbergh, of Portsmouth, was tried, by order of the Duke of Edinburgh, Admiral Superintendent of Naval Reserve. The "messenger" consists of a vessel, pointed at each end, 3 ft. 6 in. in length, made of copper, and lined with cork and composition, to resist external pressure. The inner case will carry a weight of 60 lbs. The messenger was thrown over from the *Hercules* flagship in lat. 56 49 N., long. 41 E., on July 24th. It was picked up on August 18th by a fisherman, off Hanstholmen (Jutland), and although it had been 25 days in the water, and had travelled about 1,420 miles, it was quite uninjured. It was taken to the British Vice-Consul, and on being opened, was found to contain a number of letters for England, which were at once posted, together with the following message, bearing the signature of the Duke of Edinburgh:—"This message is put overboard from Her Majesty's ship *Hercules*, flagship of First Reserve Squadron, bound from Kiel to Leith, as an experiment at the request of the inventor, and not on account of any accident or disaster. Messenger launched at 11.30 p.m.; all well, weather fine, sea smooth, wind S.S.W., force 3. The finder is requested to deliver the messenger and paper to Lloyd's Agent or the British Consul, and to note the date picked up, and the latitude and longitude of the place where found.—ALFRED, Rear Admiral."

HERRESHOFF & WHITE'S PINNACE.—An exhaustive series of comparative trials, extending over three days, has lately been made by the steam departments at Portsmouth Dockyard with a Herreshoff and a White's 48 ft. pinnace. The Herreshoff is worked on the inventor's coil boiler principle, and has both the engine-room and the stokehold enclosed, forced air being used at a pressure of 2 in. as measured by the water gauge. White's, on the other hand, is an ordinary service pinnace, having only the stokehold enclosed, and is propelled by twin screws. As the result of six runs on the measured mile in Stoke's Bay, the Herreshoff realized a mean speed of 15·124 knots, and White's a speed of 12·604 knots an hour. No diagrams were taken, as Mr. Herreshoff objected to their being taken with a closed engine-room, so that the horse-power developed was not ascertained. The vessels were also tested with respect to the economical consumption of fuel. Each pinnace took on board 10 cwt. of coal, and having proceeded to the westernmost measured mile buoy, were kept running at full power until the engines stopped for want of steam on the consumption of the coal. The Herreshoff went 28 times round the buoys before its fuel was exhausted, while Mr. White's boat, after going 29 times round the buoys, proceeded into harbour, having 258 lbs. of coal unconsumed at the end of the trial.

WOODEN VEDETTE TORPEDO BOATS.—The two wooden vedette torpedo boats which Mr. Trevelyan stated had been purchased in America at a cost of £2,500 each, would appear to have been bought somewhat at random, and without sufficient care as to their satisfying the usual requirements previous to being accepted. They are built of yellow pine, and though they resemble in length and beam the ordinary service pinnaces, they are considerably lighter in the water, and are wanting in the air chambers which convert the English-built pinnaces into lifeboats. On being tested at Portsmouth against a pinnace built by Mr. T. White, of East Cowes, they were found to realize a higher rate of speed, but with a greater consumption of fuel, and a considerable loss of stiffness, and as several improvements have been since introduced into 48ft. pinnaces, it was proposed by the officers at Portsmouth to try the American craft against a new White pinnace which has been supplied to the *Inflexible*, and which from its remarkable handiness has been called the Turnabout. This competition was accepted by the American builder, but eventually declined, on the ground that he did not stipulate for a manœuvring trial. A day was fixed by the Portsmouth officers for the English and the American pinnaces to be inclined for the ascertainment of their respective stabilities, and they were accordingly placed in the mast pond for the purpose. A certain amount of iron ballast was placed in the stokehole to represent the coal, while other quantities were disposed in various parts of the craft to represent the weight of the torpedo gear and other fittings. The Americans, however, objected to this arrangement; they insisted upon the ballast being placed in the main cabin and along the keelson, and as the constructors would not agree to a test which would be of no practical value, the ballast was all withdrawn. The builders contend that stability forms no part of the conditions, and as the stipulated speed has been more than realized, the Admiralty will have to accept the pinnaces as they are.

AN ARGENTINE IRONCLAD.—The *Almirante Brown* left her moorings at Greenhithe on August 16th, and steamed past the Nore for gun practice. Her armament consists of eight 8-in. 11½-ton breech-loading Armstrong guns of the new type, firing projectiles of 180 lb. weight, with 90 lb. battering charges. There are besides six new type 40-pounder breech-loading guns on automatic carriages together with smaller guns. A couple of rounds were fired from each of the guns in the course of the practice. Although the battering charges of the guns are twice as large as those of the guns of similar weight in the British and other services, no injurious results of any kind were observed in any part of the structure or fittings of the ship, or in the carriages or appliances of the guns. The *Almirante Brown* returned the same afternoon to Gravesend, and is expected to leave for South America in a few days. It will be remembered that this vessel has been constructed by Messrs. Samuda, at Poplar, the armament being arranged and supplied by the Elswick firm. She is built entirely of steel, is of 4,200 tons displacement, and 4,500 indicated horse-power. In her trial trips on June 14th she attained an average speed on six runs of over 14 knots an hour. Her eight 8 in. guns are so mounted that three of them can be fired straight ahead, three straight astern, and three on each broadside. The gun has penetrated, at Shoeburyness, an unbacked, solid wrought iron armour-plate of 16 in. thickness, and is, therefore, competent to pierce the great majority of ironclads. In range it exceeds all the guns as yet mounted in the British Navy, and in penetrative power surpasses all but the guns of the *Inflexible*, *Dreadnought*, *Devastation*, and *Thunderer*, which vessels carry only four guns each. It has been, together with the 6 in. 4 ton gun, very exhaustively tested by a mixed War Office and Admiralty Committee. The Admiralty have ordered the *Rover* to be armed with twelve of the 6 in. 4 ton Armstrong guns, in place of the existing armament, and have ordered 103 similar guns to be made at Woolwich, so as to carry further such substitution. But no step has been as yet taken towards replacing the existing 12 ton guns of the Navy with the new type 8 in. guns. This gun became famous in the Chilian war, and the Chilians are now re-arming their navy (including Sir E. Reed's ironclads and the well-known *Huascar*) with it, and larger guns of the same type.

AUSTRIAN TORPEDO BOATS.—The trial of the first of two sea-going torpedo boats built for the Austrian Government by Messrs. Yarrow & Co., of Poplar, took place lately, and resulted in perfect success. The run took place over the measured mile at Long Reach, and was attended by Count Cassini, the Austrian Naval Attaché, and the chief officials of the constructive and engineering departments at Pola. The vessel is of the Batoum type, but in many respects is an improvement upon that vessel, which was built for the Russian Government by the same firm last year. She is steel built throughout, her dimensions being, length 100 ft., beam 12 ft. 6 in., and depth 6 ft. 6 in., which give a thoroughly sea-going craft, and one capable of holding sufficient fuel for a run of from 800 to 1,000 miles at a ten-knot speed. Her engines are on the compound principle, the high-pressure cylinder being 12½ in. and the low-pressure 21¼ in. in diameter, with a stroke of 16 in. The boilers are of the locomotive type, with 922 square feet of heating surface. She is propelled by a single screw, having a diameter of 5 ft. and a pitch of 6 ft. 6 in. She is steered from a conning tower placed forward, and has two rudders, one a balanced rudder forward, and the other aft, which is of the ordinary form. She will be fitted with steam steering gear. Her engines are placed forward, and her boilers aft, and she has a closed stokehole, air being drawn from the engine room, to which it is admitted by a series of small air syphons, instead of one large ventilator, as in ordinary practice. This is one improvement which has been introduced, while another is the addition of means for working the engines at high pressure should the condenser get pierced. If a leak should occur, ample pumping power is provided to cope with it, as there is a 2-inch hand pump, a 3-inch steam pump, and the 4-inch circulating pump of the engines available. This vessel will fire two Whitehead torpedoes, and another improvement introduced by Messrs. Yarrow is the disposition of the torpedo tubes. Formerly they opened out from the bows, one on either side. They are now completely encased, and provision is made at the bow of the boat for a man to go down and obtain access to the front end of the tubes. According to the terms of their contract, the builders were to obtain a speed of 20½ knots per hour, but the result of the trial yesterday was a speed of 22·1 knots. The engines are of 550 horse power indicated, and this was obtained on the trial run with a steam pressure of 112 lbs. per square inch, and 440 revolutions per minute. It is to be observed that the trial was not made with the vessel light, but with 20 persons on board and 2½ tons of coal, which is sufficient to carry her a 300-miles run.

A PATENT CUTTER.—The Admiralty are so well satisfied with the handiness and performances of the 25 ft. cutter which has been built for the Navy by Mr. J. Samuel White, of East Cowes, with the after deadwood cut away, that they have proposed to construct a corvette on the same principle at Chatham. But in order that the sailing qualities of the patent cutter might be tested against an ordinary cutter of similar size and form, as it was thought that a large amount of weather helm would be required in the new craft to keep her head to windward, Lieut. Scullard and Lieut. Pelly were deputed to make the comparative trials. The trials have just been completed in the Solent, and have demonstrated that the superior manœuvring powers of the patent cutter have entailed no loss of steadiness or seaworthiness. The new cutter was precisely the same as the one which has been supplied to the *Inflexible*, the only difference being that it is fitted with a two-bladed, instead of a four-bladed propeller, so that the blades, when not under steam, might be allowed to remain vertically in the water, and thus present no resistance to the way of the boat when under sail. The vessel is steered by means of two rudders, the after one being stepped upon a shoe, and both are worked by the same tiller, which is fitted with a sprocket wheel and chain arrangement. The sail power, which is considerable, consists of mainsail, foresail, and mizzen, with a lateen rig. The two cutters were first tried with the after deadwood attached, and the sailing qualities of each having been ascertained to be about the same under all conditions of wind, the deadwood of the patent craft was then disconnected, and the two were afterwards tried in competitions on and off a wind. With the wind astern there was practically no difference in their respective performances, but in tacking to windward the patent cutter ran away from its service rival, going about in from 20 to 22 seconds, or half the time required by the other. The moment the helm was put down she came up to the wind. Contrary to what was expected on the part of the naval authorities, no weather helm was needed to keep the patent cutter to the wind, the tiller being kept amidships. In a larger vessel, however, it was held to be desirable to remove the centre of effort forward by advancing the mainmast about 3 ft.

THE "NELSON."—The *Nelson*, armour-clad, Captain Erskine, arrived at Spithead at the end of her week's cruise for the trial of her machinery, previous to sailing for the Australian station. She was inspected at Chatham by Admiral Macdonald, and started for her cruise in the Channel. Soon after leaving, a serious leak was discovered in the port high-pressure cylinder cover, and as a rejointing was necessary, as well as a readjustment of the crank-bearings, the *Nelson* put into Portland. She continued her trial, and was again compelled to put into Portland through stress of whether. In the meantime, a series of seven trials were made under various conditions of steaming, the engines and boilers working very satisfactorily, the latter yielding sufficient steam during the six hours of full-power trial without having recourse to the blast. Water, however, was required upon the crank-bearings to keep them cool, and some readjustments will be necessary before the ship leaves Portsmouth. The following *maximum* results were obtained:—With four boilers working, the revolutions were 47, the horse-power 1,783·65, the mean speed 6·95 knots, the consumption per unit of horse-power per hour, 1·7 lb.; with six boilers the results were:—revolutions, 63½, horse-power, 3,067·01, mean speed 10·6 knots, and consumption 1·9lb.; while, with all the ten boilers lighted and the engines going at full power for six hours, the results were as under:—revolutions 80, horse-power 6,219·14, mean speed 13·33 knots, and consumption 2·2lb. The whole of the results were realized without the use of the blast, the object being to work the engines as economically as possible. The complement of stokers on board is greatly below the requirements of the case, and a dozen of seamen were required to trim coal. The ship contains two stokeholes and two engine-rooms, and no fewer than 30 furnaces, yet the total number of stokers does not exceed 44. Besides attending to the fires, the men of this rating are employed in oiling the machinery when under way, cleaning and polishing it when at rest, sweeping tubes, and making themselves generally useful. The 44 are divided into three watches of four hours each; but the experience of the experimental cruise has proved that they are barely sufficient for two watches. The complement will probably be increased before the *Nelson* leaves Spithead, although the scarcity of this particular rating is becoming a grave inconvenience in the service.

THE Admiralty have just approved of an estimate for the building, at Portsmouth, of the *Imperieuse*, an armour-plated steel cruiser, which will not resemble any vessel afloat. The cost of her hull alone will be £325,000. Her load displacement will be 7400 tons, and her length 315 ft., with a beam of 61 ft. She will be built with four barbette turrets, and have an outer casing of wood, the barbette being armed with 18-ton breech-loading guns, having a "disappearance arrangement." Her engines will be 8000-horse power.

DURING the presence of the British Squadron at Kiel, an inspection was made by several of the engineers of a hydromotor vessel recently constructed there from the designs of Dr. Fleischer, of Dresden. In this vessel the usual ship's engines, worked by means of wheel or screw, are replaced by hydraulic reaction, by the drawing in and ejection of a stream of water. The great and novel feature of Dr. Fleischer's application of this principle is the immediate operation of the steam power upon the water, without any loss of such power in conveyance from steam engines and pumps. While the new hydromotor allows of as much as 90 per cent. of the indicated steam power being applied to the production of the outflowing water stream, not more than 30 per cent. has been secured with the reaction machines hitherto constructed. By the new invention the manœuvring capabilities of the vessel are also greatly increased. The usual complicated machinery is replaced by a remarkably simple contrivance, which cannot easily get out of order. The professional gentlemen who took part in a short trip with the hydromotor, at the request of the Duke of Edinburgh, expressed the most unqualified appreciation of the invention of Dr. Fleischer, and of every detail of its execution. The easy manœuvring of the vessel, the comparatively insignificant consumption of coal, and the practicability of adapting the system to all rates of speed were clearly manifested, and the simplicity of construction was regarded as particularly valuable for warships. It has been arranged that the hydromotor shall be sent to England for further testing.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 19th July, to 22nd August, 1881.

3135. W. Morrison and C. Norfolk. Screw propellers.
3175. A. Figge, G. A. Kottgen, and H. Wedekind. Steering and propelling.
3181. F. C. Glaser (communicated by H. Heine). Water tube boilers.
3182. P. F. Dundon. Boiler furnaces.
3186. M. Havelock. Speed governors.
3193. G. L. Lambert. Valve gear.
3203. W. Backley. Piston springs.
3219. R. Priest. Pulley blocks.
3239. J. H. Johnson, (communicated by G. S. Strong). Feed water heaters.
3251. D. Halpin. Marine Engine Water Supply.
3252. J. Short. Ships pendulum or clinometer.
3254. H. H. Lake (communicated by D. Brooks). Cable insulation.
3259. C. D. Abel (communicated by O. Petzold). Funnels.
3273. W. A. Pope. Propelling boats, &c.
3285. A. B. Rodyk (communicated by N. B. Dennys.) Anti-fouling composition.
3287. F. W. Durham. Governors.
3299. W. Hunter. Floating Cranes.
3315. P. Amati. Propellers.
3320. C. H. Mowll. Collier hold fittings.
3324. E. Lofts and H. J. Barker. Boiler tube cleaner.
3347. H. W. Blake and J. Shepherd. Steam boilers.
3360. C. J. D. Christie. Applying Water ballast tanks to screw steamers.
3372. W. R. Lake (communicated by J. H. Laskey). Sleeping berths.
3392. C. J. Allport and A. Hollings. Asbestos packing.
3393. D. M. and A. Sowden. Air supply to furnaces.
3414. R. D. Napier. Throttle valves.
3418. J. Dillon. Indicating sections or diagrams of harbours &c.
3424. G. M. Cruikshank (communicated by A. Houston). Gearing to increase and differentiate speed of shafts.
3433. A. Hugot. Lubricating.
3438. B. J. B. Mills (communicated by J. C. Thompson). Self levelling berths, &c.
3460. J. Evans and R. Low. Guns for throwing life-saving lines, &c.
3461. C. H. Smith. Low water boiler alarm.
3463. F. R. Lucas. Submarine cable protection and Communication with lightships, &c.
3488. J. Wilkinson. Screw propulsion.
3499. H. J. Haddan (communicated by J. Cornier). Loading and unloading apparatus.
3502. H. W. Pendred. Differential valve gear.
3506. R. Aytoun. Bag skips, for depositing material in deep water.
3508. J. F. C. Farquhar. Steadying floating bodies or vessels.
3515. J. W. Gibbs. Ships downcast ventilating cowls.
3528. F. H. Holmes. Fog signalling.
3545. G. W. Von Nawrocki (communicated by C. Schondelmaier). Artificial bait with striking apparatus.
3550. H. Reisert. Lubrication.
3552. J. R. Oldham. Steam boilers.
3555. H. Redknap. Conveying articles and messages from ships
3556. E. C. G. Thomas. Breakwaters and harbours.
3561. A. H. V. de Kerchore and T. Snyers. Propulsion.

3563. W. Clark (communicated by F. L. Roberts). Utilizing power of waves.
3571. F. Burroughs. Dredging.
3578. M. H. Robinson. Boat disengaging gear.
3579. B. L. Thomson. Protecting submerged surfaces.
3589. J. Tangye. Mounting rotating shafts.
3611. T. Hancock. Sorting and loading coal.
3634. H. Garland. Grain elevator.
3642. F. Nash. Fire bars.
3647. J. Walker and W. & T. Thompson. Steering apparatus.

⁂ Any information regarding these or other patents will be gladly furnished on application.

AT Newport (U.S.) the second official trial of a new submarine torpedo-boat was made before several army and navy officers. It was directed from the shore by an electric current, and the adjustable switch on board worked perfectly. It went half a mile in 2 minutes 53 seconds, was made to stop and start at will, go to port and starboard, and brought back to the starting point. The trial is said to have been a success in everything except speed, which was little more than 10 knots an hour, instead of 13, as the inventors claimed. At the third trial the time was 2 minutes 42 seconds.

NEW DOCK AT DUMBARTON.—A squad of workmen have commenced to construct a new dock in connection with the Leven shipyard, belonging to Messrs. William Denny & Brothers, Shipbuilders, Dumbarton. The new dock is almost immediately under the shadow of Dumbarton Castle, and sheltered from the wind in every direction. It will extend from the mouth of the River Leven, run across the grounds of Castle Green, and extend on to the Castle-road and beyond a distance of about 120 ft. The extreme length of the dock on the side next the Castle will be 920 ft., and on the side next the Leven shipyard 650 ft. The breadth of water surface in the dock at high water will be 230 ft., and the extreme breadth of the dock to the edges will be 250 ft. On the side of the dock next the Castle there are to be a pair of iron shear-legs capable of lifting 100 tons at one lift, and of such a height and overhang as to be capable of putting this weight on board the largest and broadest of vessels. As at present arranged, the draught of water in the dock at ordinary spring tides is to be 20 ft., but the dock is so arranged that it can be deepened ultimately to 25 ft.

TRIAL OF THE LARGEST DREDGER IN THE WORLD.—On July 15th the new iron hopper dredger recently constructed by Messrs. W. Simons & Co., Renfrew, for Otago, was tried on the Clyde, and dredged at the rate of 400 tons per hour, which was plunged into its own hold or hopper cavity, capable of containing 1,300 tons of spoil. At the same time it loaded with several hundred tons the new Government steamer *Perseverance*, which came alongside. Afterwards, by steam appliances, its bucket girder was elevated, and its twin screw propellers put in motion, and the vessel steamed away down the Clyde to the measured mile, where the loaded speed was tested at 7½ knots per hour; the vessel then steamed down the Firth of Clyde, where its large cargo was instantly deposited through its bottom in 60 fathom water. This vessel dredges from 5 ft. to 35 ft. depth, has twin screws, and is propelled and worked by two independent sets of compound engines of 700-horse power, and besides loading its own cargo, it can fill if required a fleet of barges on the old system. It is the property of the Otago Harbour Board, and will steam to New Zealand. The trial of dredging, steaming, manœuvring, and depositing, was considered very satisfactory; this being the tenth and largest hopper dredger constructed by Messrs. Simons & Co., who are the inventors and originators of the system. It is also worthy of note, that owing to the enterprise of the above small colony, they will have a dredger the equal of which is neither in Europe nor America.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

July 30th, 1881.

Ainslie, David	2 C	Leith.
Allen, Wm. G.	2 C	London.
Begg, Arthur	1 C	N Shlds.
Brown, Joseph	2 C	Glasgw.
Campsie, Peter	1 C	Dundee.
Chaston, Edwd. C.	2 C	N Shlds.
Davidson, John	1 C	Glasgw.
Dick, Robert	1 C	N Shlds.
Dick, William	1 C	do.
Dodds, Wm. H.	1 C	do.
Douglas, Alex.	1 C	Lvrpool.
Downie, James	1 C	Glasgw.
Easton, Thomas	1 C	N Shlds.
Harrison, John	2 C	Sndrlnd.
Henderson, John	1 C	Glasgw.
Herriot, Frank	1 C	Lvrpool.
Howe, Robert	2 C	Dundee.
Hubbard, Albert	1 C	N Shlds.
Jones, David R.	2 C	Lvrpool.
Kilburn, John W.	2 C	Sndrlnd.
Lindlater, Wm. N.	1 C	do.
Linn, Archibald	1 C	Glasgw.
McGregor, Duncan	2 C	Dundee.
McLennan, John	2 C	do.
McKenzie, John	1 C	Glasgw.
McOwnie, Walter	2 C	do.
Metcalfe, Thomas	2 C	Lvrpool.
Mitchell, James P.	2 C	Glasgow
Morrison, Robert	2 C	do.
M'Nicoll, Walter	2 C	N Shlds.
Neilson, Robt. D.	2 C	Glasgw.
Nicholas, David C.	1 C	Lvrpool.
Shaw, Benjamin	1 C	Sndrlnd.
Simpson, John	1 C	Glasgw.
Spencer, Thomas	1 C	N Shlds.
Spoor, William	1 C	do.
Stewart, Robert	1 C	Sndrlnd.
Steel, William	1 C	N Shlds.
Thompson, Fdk. J.	2 C	Lvrpool.
Thompson, Geo.	2 C	Glasgw.
Urie, Thomas	1 C	do.
Ward, John	2 C	Lvrpool.
Wilkinson, Jsph.	2 C	N Shlds.
Williams, Wm.	2 C	Lvrpool.
Wilson, Robert	2 C	Glasgw.
Riego, A. N.	2 C	London.
Shellard, Albert	1 C	Bristol.
Thomson, James	2 C	London.
Wagg, Henry A.	2 C	Hull.
Welch, John	2 C	Lvrpool.
Withell, John	2 C	London.
Wyllie, R. John	2 C	Lvrpool.

August 6th, 1881.

Barrow, Wm. F.	1 C	Bristol.
Bell, Joseph	2 C	Hull.
Berriman, John H.	2 C	Bristol.
Black, Wm. C.	2 C	Lvrpool.
Cound, Thomas	1 C	London.
Davidson, John	2 C	Bristol.
Fraser, James	2 C	London.
Gordon, William	1 C	Lvrpool.
Kirby, Robert J.	1 C	London.
Lethbridge, Thos. H.	2 C	Bristol.
Marshall, James	1 C	London.
Martin, Thomas	2 C	Hull.
McKechnie, Chas.	2 C	Lvrpool.
Murray, Andrew	1 C	Lvrpool.
Owen, John Wm.	1 C	do.
Roberts, Wm.	1 C	London.

August 13th, 1881.

Auburn, Thos.	2 C	N Shlds.
Allan, James	2 C	do.
Allan, Andrew S.	1 C	do.
Austwick, E. A.	2 C	do.
Bellew, Evelyn	2 C	Glasgw.
Bonar, William	2 C	do.
Bickford, John T.	2 C	Plymth.
Cargill, Andrew	2 C	Grnock.
Carruthers, Wm.	2 C	Glasgw.
Clark, Robert	1 C	N Shlds.
Cooper, James T.	1 C	London.
Elliott, James	2 C	N Shlds.
Fawcus, Robt. F.	1 C	do.
Flood, James	2 C	Glasgw.
Hardy, Forster	1 C	N Shlds.
Hudson, Francis	2 C	do.
Hughes, J.	2 C	Dublin.
Jones, J.	2 C	do.
Kerr, Archibald	2 C	N Shlds.
Keppell, John	2 C	do.
Lewis, Robert A.	2 C	London.
Moodie, James	2 C	Glasgw.
McBurnie, Geo. W.	2 C	Lvrpool.
McIntyre, Robert W.	2 C	Glasgw.
McKear, Alex.	2 C	London.
McLarty, J.	2 C	Leith.
McNab, Adam	1 C	Glasgw.
Padley, A.	2 C	Lvrpool.
Power, John	2 C	Grnock.
Reid, Robert	2 C	Lvrpool.
Robertson, A.	1 C	do.
Rose, Joseph	1 C	N Shlds.
Shaw, Andrew	2 C	London.
Thompson, Albert A.	1 C	Lvrpool.

August 20th, 1881.

Arthur, John A.	1 C	S'amptn.
Cooper, Geo. F.	2 C	Hull.
Dawson, Geo.	2 C	N Shlds.
Fordyce, John	2 C	London.
Fowles, Arthur	2 C	N Shlds.
Garson, John	1 C	do.
Hammond, Jsph.	2 C	do.
Marshall, Robt. L.	1 C	Dundee.
Mather, Alex. C.	2 C	London.
Mearns, Alex.	2 C	N Shlds.
Newcombe, Richd.	2 C	Lvrpool.
Noble, Peter	2 C	Abrdn.
Prowett, Wm. Hy.	1 C	Shmptn.
Stewart, Robert	1 C	Glasgw.
Thompson, George	2 C	N Shlds.
Tilston, Thomas	2 C	Lvrpool.
Williams, John Thomas	2 C	London

ROBERT JACKSON, Registrar-General.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, OCTOBER 1, 1881.

EDITORIAL NOTES.

The explosion of the *Doterel* has drawn the forcible attention of the authorities to the accumulation of gas in the coal bunkers of Her Majesty's Navy. We understand that the alterations in most of the Navy are to be very radical and thorough. Enquiry has elicited the information that there is scarcely any important vessel in the Navy that has not experienced such an explosion, but as they have generally been unaccompanied with serious results, not much attention has hitherto been paid to them. When the gas has had room to expand, and the adjacent parts have been iron, no great inconvenience has been experienced. It is now, however, determined to remove, as far as possible, all chance of the recurrence of such explosions, and extensive alterations are being made on board the *Inflexible*, now at Portsmouth. When the Channel squadron returns to England after the forthcoming cruise, the *Agincourt*, *Minotaur*, and *Northumberland* will be also overhauled. We understand that every ship in the Channel squadron has experienced at least one such explosion in the course of the last two years, and the *Minotaur* no less than three times. What is the experience of the mercantile engineers in this matter?

The Thames is shortly to see great modification and extension of its docking accommodation. It is absurd to see the present enormous, lengthy, and deep draught steamers creeping cautiously up the winding and narrow reaches of the Thames, obstructed as they are, in addition, by all sorts of crafts and barges. New docks are already proposed both at Gravesend and at Tilbury, nearly opposite the latter, by the East and West India Dock Company. This latter, if carried out, which we do not doubt will be the case, will be one of the greatest dock enterprises in the world, and have the greatest effect upon the encouragement of London mercantile commerce. It is proposed to purchase 480 acres of marsh land at Tilbury, which lies between the river and the London, Tilbury, and Southend Railway. The communication is thus very direct through the latter railway, with Fenchurch-street, with the Companies' warehouses, and with the great trunk lines of railway. It is intended to construct docks with a river entrance of 200 ft. wide, opening into a basin 16 acres in extent, with a lock 700 ft. long, and 41 ft. deep. The average depth of the main basin is to be 35 feet. The dock is calculated to give accommodation to 30 large steamers averaging 400 ft. in length. The estimated quay frontage is to be 15,000 feet, and graving docks, coaling, and fitting out berths, are also to be provided in the main dock. Large vessels need thus no longer anchor at Gravesend to wait for a flood tide up the river, but enter the docks at once, and thus save all river pilotage and towage. The estimated cost of all works, land, and expenses, is £1,000,000.

We are glad to see, or rather hear as yet, that the Engineers of the Royal Navy are at last to have some justice done them. We understand, on good authority, that the Board of Admiralty are at the present moment engaged in revising and amending the Code of Regulations defining the status of Engineers of the Royal Navy. It is understood that there will soon be many promotions from third to second class, and from second to first. Beyond this, the rates of payment, and the periods of active service necessary to qualify chief engineers for retirement, are to be materially improved. Greater inducement is also to be offered to young engineers of good education who may have passed a practical apprenticeship with private firms to enter the service. If these reforms are properly carried out, and the justice, so long delayed, at last rendered to the engineers of the service, so as to recognize them on equal terms, and as much gentlemen as their brother officers of the other branch of the service, there is no reason why the Royal Naval Engineering Service should not be as popular and well-filled as any other branches of the Military profession. There are many worthy Naval Engineers now afloat to whom the early pledges of promotion by the Admiralty, after certain years of service, have never been fulfilled. At last these crying evils seem likely to be remedied.

THE animated and continuous discussion on the tonnage measurement question in the daily papers, points out there is much room for improvement, and need for alteration in the present methods in use. It seems to us that there is a great deal of unnecessary personal bickering over terms and methods of measurement, whilst the grave question as to the advisability or otherwise of alteration from the present system is very much lost sight of. Who cares what particular rules are adopted for obtaining the different tonnage measurements, whilst no decision is arrived at as to the evils of the present system to ship-owners, or more especially to the ships themselves? There seems little doubt to our mind that in very many cases the seaworthiness of vessels is sacrificed to the object of making them carry the maximum cargo with the least tonnage measurement. And to an equal extent are the accommodations for captain and crew crippled and spoiled for the same reason. If these are accepted facts, and we see no reason to doubt them, they are crying evils infinitely worse than the question of any unequal incidence of rates in different styles of vessels. This latter point is only a market question which rights itself in the long run by the lowering of freights and passage fees where the tonnage dues were found to fall lightly or *vice versa*. The former is a question of life and death. We think certainly the great desideratum is a form of tonnage measurement which shall leave the greatest scope to builders to suit their vessels to their relative business with best attention to seaworthiness and comfort of passengers or crew. The rating by displacement tonnage only when light, leaves the whole conflicting question of maximum load-line on one side, and least affects the necessary covering of decks, the sheer of the vessel, and the construction of deck houses. This appears to us by far the simplest solution of the matter, and simplicity is always the greatest possible advantage in any system of measurement desired to become international. To spoil such an excellent solution by questions of equality of incidence is as bad as if each railway passenger's fare was assessed on the value of what he carried about him, or as if postage were charged according to the value of the contents of a letter. Tonnage dues are a charge for accommodation, which can best be assessed on external dimensions and draught, and ought not to be an income tax assessed on the value of the cargo carried.

THE principle of forced combustion to produce temporary acceleration of speed is now receiving more especial attention for general application to vessels of war. There can be little doubt that an increase of speed of two or three knots above average speed during an engagement, would almost certainly give the victory to any ironclad possessing that advantage over an otherwise equal antagonist. This additional access of speed it is easy to give, if the vessel is built on proper lines by a suitable arrangement of forced blast. The height of a steamer's funnel is always so comparatively low as not to afford any very considerable draught to the furnaces, and in tropical heat the draught is still further reduced. A steam jet in the funnel has already been used with some slight success in increasing the draught when desired, but a much more powerful and complete arrangement would be necessary to give the two or three additional knots which would be required to be of any service. It is still an open question whether this may be best obtained by more powerful induction steam jets, or by the closing of the ash-pit and fire-doors, and the injection of a forced blast by fans. We are inclined to think that the latter plan only will be likely to prove serviceable. A steam jet is a very wasteful way of attempting to produce a strong current of air, and if long continued and of great force will set up a tremor very destructive to the boiler. The volume of air injected by the fan may be increased or regulated at will, and the proportion of power required to drive the fan or fans is comparatively little. Besides, when not required for the furnaces, the blast of air may be made very serviceable for additional ventilation. Torpedo boats have already been fitted in this way by Mr. Thornycroft, and the *Polyphemus* is to be worked entirely on the system of a forced blast. No doubt this system will be soon largely extended throughout the fleet for use when in action.

NAVAL & SUBMARINE ENGINEERING EXHIBITION.

WE are glad to see that the Agricultural Hall is to be the scene next year of a novel and exceptionally useful exhibition. It is to be one representing the naval and submarine engineering manufactures, special attention being given to, and prizes offered for, the best inventions for saving life at sea.

The value of such exhibitions cannot be too highly estimated to the departments and trades represented therein. They most efficiently serve to bring suppliers and users into immediate contact in the simplest and most convenient manner. It is far too often the case that those who might benefit by the results of invention and progress remain in lamentable ignorance of what ingenuity may have effected for their benefit. Busy men have little time to pay attention to circulars or touters, and ideas presented in such a form take little hold upon the mind, even when heard, compared with the effect produced by the practical results of inventions experimentally shown.

There are few men, however busy they may be, but can find the time to make a visit to such a concentrated mass of information as is afforded by an exhibition. More particularly is this the case when the exhibition is limited to a definite class of exhibits. The international exhibits of general scope are far too vast, varied, and consequently incomplete in the different sections, to be of any very great business value to any manufacture or trade. The limited and distinctive class exhibitions held at the Agricultural Hall have hitherto proved most serviceable to the trades thus represented, and the Naval and Submarine Engineering Exhibition promises to be the most interesting and extensive of any yet held. Perhaps we are partial in this opinion, as feeling a special personal interest in the subjects of exhibition, but few have better opportunities than ourselves for knowing the immense variety, scope, and ingenuity now employed in the construction and equipment of our merchant fleet and navy.

Our merchant navy now musters nearly 40,000 vessels, of which one-fourth are steamers, and almost every day brings forth some improvement or novel apparatus for the better working of the powerful engines and numberless mechanisms with which modern steamers are now crowded.

Humanity also, in the form of safety from drowning, receives now-a-days a greatly increased amount of attention, and devices of great ingenuity and simplicity for that purpose require but to be seen to be appreciated. The opportunity and the prizes offered by the Naval and Submarine Exhibition will, no doubt, cause a most interesting number of these appliances to be practically exhibited in the large tank which is to be a great feature in the exhibition. This tank is specially devoted to submarine diving apparatus, and there is much that is new in this department that has only lately been introduced.

All manner of ship fittings, from boilers and pumps to distilling apparatus and tube expanders, are included in the special items of exhibits. Electricity in the form of lights, telegraphs, steering, and signalling apparatus will, no doubt, be conspicuously to the front amongst the more modern inventions, whilst ventilating apparatus will not be forgotten.

We look forward to this exhibition as promising a great treat in the mass of novel matter which we expect to be therein set forth, and we shall certainly do our best to make our readers *au fait* to all that there will be of interest therein.

HER MAJESTY'S SHIP "CONQUEROR."

THIS new steel armour-plated turret-ship and ram, which has been constructed at Chatham Dockyard, was successfully floated out of dock on September 8th, in the presence of a large concourse of spectators; but the attendance of the public was not so large as on the occasion of vessels being launched from slipways, the proceedings at a float-out being merely the hauling out of dock.

In some of its features the *Conqueror* is not uninteresting, and may with advantage be noticed. Perhaps the armoured ram *Rupert* will suggest the best idea of its character and capacity: It is like this vessel, but on an enlarged scale, and is, moreover, in many ways modified. Its length is 270 ft., and breadth 58 ft., the figures for the *Rupert* being 250 ft. and 53 ft.; but the mean draught is about the same—23 ft.—for both vessels. Whereas the displacement of the older vessels is 5,400 tons, that of the *Conqueror* is estimated at 6,200 tons; the indicated horse power of the two vessels being, respectively, 4,200 and 4,500; but the same speed of 13 knots is anticipated for both vessels. Generally speaking, therefore, in point of size, there is a fair resemblance between the vessels, but in a few striking points the difference is considerable. Notably is this the case with armour and armament. The introduction of steel and the invention of steel-faced armour have done a good deal to revolutionize construction, while the decision of the Government to introduce at once breech-loading ordnance into the British Navy has created a revolution in the armaments of men-of-war. Here it is, then, that the *Rupert* and her new-born sister part company. While the plating of the former vessel was limited to armour of from 10 to 14 inches thick of iron, the armour of the *Conqueror* will consist of steel-faced iron-plates of 12 inches thick at the water-line, 11 inches on the battery, and from 12 to 14 inches on the turrets. In point of thickness it will be observed that this plating is in no way thicker than that borne by the *Rupert;* but it may also be noted that this armour, with its face of steel, is calculated to be equivalent in point of resistance to four additional inches of iron armour as carried by the *Rupert.* In fact, this new device may be reckoned to be worth the addition of 25 per cent. of iron armour, and, for the purpose of comparison, the *Conqueror's* plating may be considered equivalent to from 14 to 18 inches of the iron with which the other vessel is protected. The deck armour which is now introduced generally into ironclad construction consists of steel plating of two and three inches thick.

The second important point of difference is in armament. While the *Rupert* carries two 25-ton guns of the old-fashioned muzzle-loading type, the *Conqueror* will be provided with four breech-loaders, two for the turrets, of 43 tons, and two six-inch guns outside the turrets, presumably for use as chase guns. It will be seen at once that there is no comparison between the vessels on this head. Both in character and calibre the new vessel has an overwhelming advantage over its rival. The decision to provide our men-of-war with this gun is so recent that an extract from Mr. Trevelyan's authoritative statement on the subject may be pardoned, and can hardly fail to be read with great interest. He states:—

"On the 24th of May last year the War Office wrote a letter to Sir William Armstrong, inviting him to send a breech-loading gun of 43 tons for an experiment. Sir William accepted the proposal, but asked for ten months to complete the task, so heavy and complicated were even the preliminaries of this great undertaking. There was some correspondence and a little difficulty before the specification of the gun could be arranged, but the Elswick gun was actually finished on the 11th of last month."

There it is at Woolwich, awaiting its trial; and this is the gun with which it is proposed to arm the *Conqueror*, care being taken to select, test, and complete the ordnance for this vessel and others now under construction in sufficient time to arm them when they are ready for sea. The other class of ordnance—namely, the four-ton or six-inch gun—has already been tried, and fourteen were ordered for the use of the fleet by Mr. W. H. Smith when he was at the Admiralty. In fact, so great is the progress with these powerful small guns that 103 are already ordered for the use of corvettes and unarmoured vessels, and a definite attempt has at length been made to remove the reproach to which the armaments of our large unarmoured vessels, such as the *Shah* and *Raleigh*, were justly open. It may be noticed that the *Conqueror's* turret guns fire over a clear upper deck, and command an uninterrupted training across the bow from about 50 feet abaft the beam on one side to an equal angle on the other. The value of machine guns, such as the Nordenfelt and Gatling, is now regarded as absolute in men-of-war, and provision has been made for a fair supply of these weapons; while in the matter of torpedoes provision is made for the use of the Whitehead under water, as in the *Inflexible*.

The vessel has been nearly three years in course of construction, but she is still in an incomplete state, and will not be ready to be commissioned for some time to come. When she left the dock her draught of water forward was only 10 ft., but then a large number of her armour-plates have yet to be placed in position.

The time fixed for the floating out of the vessel was twelve o'clock, and by that time numbers of persons had assembled. A small platform had been erected at the head of the dock for the accommodation of those taking part in the ceremony and for officers in uniform. Among those present were Vice-Admiral Sir J. Macdonald, K.C.S.I., Commander-in-Chief at the Nore; Rear-Admiral T. Brandreth, Admiral-Superintendent of Chatham Dockyard; Major-General the Hon. R. Monck, Commandant of the Chatham district; Colonel Sir A. Clarke, K.C.M.G., C.B., C.I.E., Commandant of the School of Engineering, Chatham; Colonel-Commandant Connolly, R.M.L.I.; Mr. R. P. Saunders, chief constructor; Mr. Stainer, Constructor; and the Rev. W. B. Smith, B.A., dockyard chaplain. The band of the Chatham division of Royal Marines was present, and played several pieces before the ceremony. Just before twelve o'clock the dockyard chaplain read the prayers appointed to be read at launches, the people uncovering. The "christening" was performed by Lady Clarke, wife of Sir A. Clarke. The apparatus used for christening the vessel was similar to that used at launches. After this ceremony the vessel slowly left the dock, being hauled out by means of ropes in the hands of a large number of dockyard men; and after getting into the river, the vessel was moored alongside the iron battery *Thunderbolt*. The whole of the workmen in the yard were granted a half day's holiday. The arrangements in connection with the floating-out were carried out most successfully under the direction of Mr. R. P. Saunders.

SILICATE COTTON OR SLAG WOOL.

A REALLY good non-conducting covering for boilers and steam pipes is a very great desideratum on board ship. The spaces reserved for stoke-holes are so confined and so badly provided with fresh air, that the heat is frequently unbearable, as many of our readers know.

When so good and simple a non-conducting covering as the new and improved form of silicate cotton or slag wool is to be had, it will be great remissness on the part of ship-owners if the stoke-holes are not for the future made comparatively cool and comfortable.

Slag wool is produced from iron slag by the passage through it of a blast of steam. This product has been known for some years, but hitherto it has been in a loose and friable condition, which has afforded many objections to its use. The only method of application formerly has been to pack the loose slag wool under a wood or iron casing, where it would gradually pulverize and settle to the bottom of the casing, losing at the same time its principal non-conducting properties, and besides be liable to get into parts of the machinery. The broken portions of the slag wool were also most irritating, and almost dangerous to the lungs of those who might inhale them.

Messrs. Daniel H. Dade & Co., of Bermondsey, however, have not been deterred by all these objections to the use of this novel and valuable material. They, who were, we believe, the first to introduce it, have, after many months' experiments, perfected processes by which silicate cotton is made into a composition, boards, cement, plaster or powder, as may be most convenient for a large variety of purposes.

In all of these forms the fibre is so held together that there is no longer any annoyance from floating particles. At the same time the porosity of the material, which is essential for its non-conducting properties, is fully maintained.

The Silicate Cotton Composition seems essentially suitable for boiler coverings for many reasons beyond its excellent non-conducting properties. When laid on it will not crack and peel off with the heat, as far too many do, nor will it char or burn like felt, but is practically indestructible. Though light, elastic, and porous within, it forms a hard, smooth external skin, which may be varnished or painted, and thus made to look beautifully neat and tidy. It can also be easily removed and re-applied when necessary, whilst its cost is cheaper than any other non-conducting material or lagging with which we are acquainted.

The directions for use are very simple, and may be carried out by any ordinary workman.

The necessary coating is now supplied by the latest improvements ready mixed to the consistency of thick cement. It is applied by being thrown somewhat forcibly on to a hot surface (that corresponding to about 5 lbs. of steam will suffice) in small patches—not too closely together—each successive coat filling up the open spaces left in the one underneath, until a thickness of two inches all over has been obtained. The smooth outer surface can be obtained when the material is half dry by smoothing over first with the hand, and then with the trowel or straight-edge.

When it is desired to remove and re-apply the covering, it can readily be taken off by a knife and by damping, and the composition can be reduced to its former condition of cement by admixture with a special silicate cotton fluid, when it can be applied as before.

The boards or sheets of silicate cotton are also a ready and simple means of covering surfaces when cold, securing by any adhesive material or light outside hooping. These boards have the additional advantage of being readily removed and re-applied.

For water, steam, or other hot pipes, an exceptionally handy means of covering is supplied in the form by long split rings or cylinders, from 1 to 3 feet in length, which are sufficiently elastic to admit of being opened and sprung over the pipe, overlapping each other at one end. We are inclined to think that this material will come into exclusive use as a boiler or other non-conducting covering

THE HYDROMOTOR.

THE above title has been given to a novel marine motor, the invention of Dr. E. Fleischer, and which promises to effect a startling innovation in the marine world. It is well known that in the ordinary marine engine there are immense margins of loss between the development of power in the boiler, and its visible representation in the speed of the vessel. To such an extent does this loss exist in the frictional resistance of the engines, and in the slip of the propeller, that not much more than 33 per cent. of the indicated horse power is absolutely obtained in the form of nett work. Any invention then which promises to dispose of a large proportion of both these losses is worthy of the closest attention from marine engineers and ship-owners.

It has already been proved by experiment, many years ago that the efficiency of a water jet for propulsion is greater for the exertion of a given power than that of the ordinary screw propeller. All vessels, however, to which hydraulic motive power has been fitted, have had the great disadvantage that the hydraulic jet was produced by engines and pumps which both experience a considerable margin of loss between their gross and nett effect.

Dr. Fleischer has successfully introduced the Hydromotor as an apparatus for producing a propelling jet of water by the direct action of the steam, and thus saving the loss by friction and leakage of the engines and pumps hitherto employed for such a purpose.

This apparatus has been fitted to a small vessel of 105 tons called the *Hydromotor*, which is 110 ft. long by 17 ft. beam, with a draught of 6 ft. to 6 ft. 6 in., and which has made a very successful voyage from Kiel to Copenhagen and back.

As fitted to the *Hydromotor*, the apparatus consists of two reservoir cylinders, *l l*, each furnished with a large pipe, *g*, leading from the bottom of the cylinder tothe nozzle, *n*, outside the vessel, as shown. Each cylinder also is provided with a float, *f*, of nearly the same diameter as the cylinder. At *d* and *k* are respectively the steam inlet and the exhaust valves, the latter opening to a pipe which conducts the exhaust steam to the surface condenser *m*. At *l* is a valve which during the exhaust stroke allows water to flow through the surface condenser into the working cylinder. The steam inlet and exhaust valves just mentioned are worked by means of a rod fixed to the float in the cylinder, there being provided at the top of this rod feathers which work in a grooved bonnet or guide fixed on the top of the cylinder. A second movable bonnet with a curved groove permitting a semi-rotary motion is fitted over the first, and to this upper bonnet are fitted discs or cams which operate the steam and exhaust valves, and effect the cut-off at any desired part of the stroke. The action of this apparatus is as follows :—

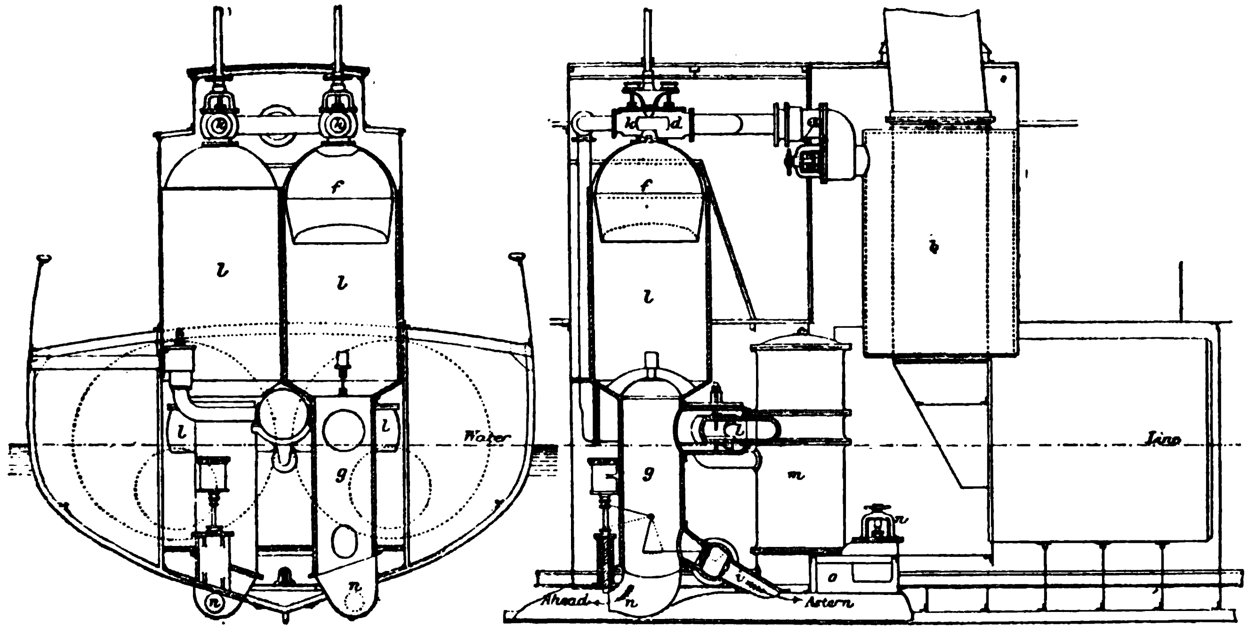
Confining our attention to one of the reservoir cylinders, let us suppose that it is full of water, and the float consequently at the top. In reaching this position the float will have opened the steam valve, and the steam entering the cylinder will press down the float and eject the water beneath it at a great velocity through the nozzle, *n*. The float will thus descend until at a certain portion of its stroke the rod above mentioned will close the steam valve, the expansion of the enclosed steam being then utilized in completing the down stroke and ejecting the rest of the water. Just as it reaches the bottom of its travel the float opens the exhaust valve, when the steam rushes into the condenser, and a partial vacuum being formed in the reservoir cylinder the water rushes in partly through the nozzle, *n*, but principally through the suction valve, *l*, thus raising the float and bringing it again to the top of the cylinder ready for the same cycle of operations to be performed. In the Hydromoter there are, as shown in our engravings, two reservoir cylinders which perform alternate strokes. In larger vessels the number of reservoir cylinders may be multiplied to any desired extent.

If it should be desired to drive the vessel astern, all that is necessary is to admit steam to the top of a small vertical cylinder shown fixed by the side of the pipe, *g*. The steam thus admitted will cause the piston of the small cylinder to descend, thus sliding down a sluice door in front of the nozzle, *n*, and at the same time through the arrangement of levers and links, shown by dotted lines, opening a valve which allows the water in the reservoir cylinder to be ejected through the passage, *i*.

The loss of steam by internal condensation in the cylinders is as the indicator diagram shows, very small, because a heated surface of water leads heat downwards but very slowly. Besides the cylinders are lined with lignum vitæ, which has a low specific heat, and is a bad heat conductor.

It is evident that nearly the whole steam power may be utilized most directly in the working stroke, and the full value of the vacuum may be realized by placing as high a working chamber as possible; the velocity of the jet will be thus increased by the column of water drawn in by the vacuum. The diagram we publish shows very satisfactorily what takes place in the working stroke, and looks like a very fair engine diagram.

The following tabular comparison of the results obtained from the *Hydromotor*, compared with the *Waterwitch* and *Rival* [turbine ships] at once gives the leading place to the *Hydromotor* :



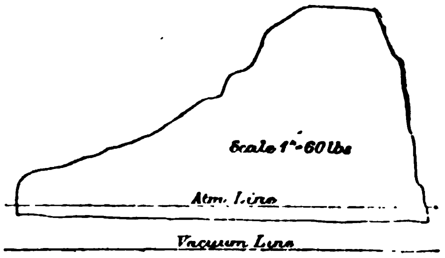
THE HYDROMOTOR.

Name of vessel	Waterwitch.	Rival.	Hydro-motor.
Displacement in tons ...	1279	about 170	105
Area of midship section ...	...	91 sq. ft.	61 sq. ft.
Speed attained	9 3 knots	7 knots	9 knots
Description of machinery..	Engine driving centrifugal pump	Engine driving centrifugal pump	Fleischer's Patent Hydromotor
Indicated horse power ...	760	292	100
Coal consumpt'n. per hour	...	832 lb.	255 lb.
Area of discharge opening	5.33 sq. ft.	3.63 sq. ft.	0.29 sq. ft.
Velocity of discharge of water in feet per second..	30 ft.	23 ft.	66 ft.
Water discharged per minute	9000 cub. ft.	5000 cub. ft.	700 cub. ft.
Horse power accounted for in the water discharged..	267 H.P.	77 H.P.	89 H.P.
Loss	64.9 per ct.	73.7 per ct.	11 per ct.

The great point of value to be noticed from these results is that the loss by transferring the steam power to the water jet is only 11 per cent. in the case of the *Hydromotor;* whilst in the only other test cases of hydraulic propulsion the margin of loss has been 64·9 per cent. and 73·7 per cent.

Hydraulic propulsion has thus, by Fleischer's invention, been placed at least on a par as regards economy with the best results of screw propulsion. The benefits resulting from jet propulsion also increase with the speed, so that for the high speeds the advantages of economy of jet propulsion will be still greater than can be at present anticipated.

A further great advantage of the Hydromotor is, quite apart from its wonderful simplicity, that all its power can be utilized to keep the vessel clear of water in the case of a leak. The dangers of breaking shafts or fouling propellers are all obviated, and a general break-down might be considered impossible.



The vessel fitted with a hydromotor is particularly well under control, as the driving power can be reversed from the captain's bridge without stopping the apparatus.

We read that the celebrated German Admiral Werner was present at the voyage of the *Hydromotor* to Copenhagen, and is of opinion that the invention is a fact which signifies a new phase in the development of navigation. Dr. Fleischer is now in London for the purpose of transferring all his patents to an international Society which shall exploit the invention in all countries.

EXHIBITION OF MACHINERY AT BIRKENHEAD.

IT is worthy of mention, as having a special interest for shipping, that at the recent Exhibition of Machinery at Birkenhead, a Silver Medal was awarded for a direct steam windlass, manufactured by Messrs. Emerson, Walker & Co., London, and exhibited by Messrs. Cochrane & Co., Duke Street, Birkenhead. The opinion of gentlemen who inspected the invention was that it is admirably adapted for its purpose, and that the manufacturers were thoroughly deserving of the distinction conferred upon them.

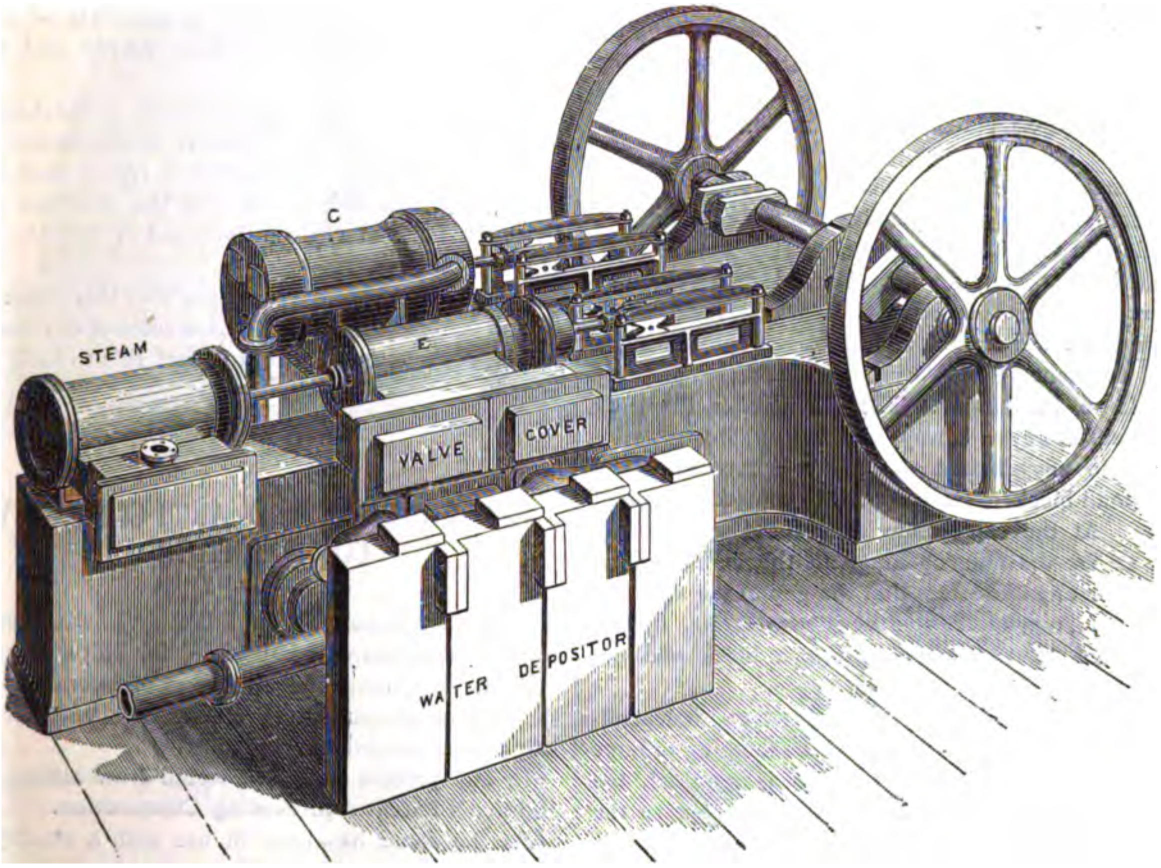
LIGHTFOOT'S PATENT SELF-CONTAINED DRY AIR REFRIGERATOR.

MR. T. B. LIGHTFOOT, Consulting Engineer, of 116, Fenchurch Street, E.C., has, as is well known, for a long time paid great attention to the subject of the mechanical refrigeration of air, both in regard to its production and application, a most interesting Paper on Cold Air Machines having been read by him before the Institution of Mechanical Engineers at their meeting held in London last January.

A number of refrigerators on one or other of Mr. Lightfoot's patents have, from time to time, been constructed and put to work, some for the freezing and preservation of meat in Australia, and others for use in manufactures where some means of producing rapid cooling was required, and we now illustrate by the perspective view above, a type of machine which though at first specially intended for use on shipboard, has now superseded previous arrangements for all purposes.

The particular machine we illustrate is in use at the Royal Victoria Docks for cooling a series of chambers for the storage and preservation of meat, fish, butter, or any perishable food, and is capable of delivering about 10,000 cubic ft. of air per hour at a temperature of about 50 deg. below zero Fahr.; which is roughly equivalent to the cooling of a chamber space of from 9,000 to 10,000 cubic ft., provided ot course the walls of the chamber are suitably constructed of a heat proof material.

The air after being compressed to a pressure of from 45 to 65 pounds per square inch, (according to the temperature of the cooling water) is passed through a series of coolers, so that it may be deprived of the heat imparted to it during compression. During this process the temperature is brought down to within 5 deg. or 6 deg. of that of the entering cooling water, and a considerable portion of the moisture passing in with the air is condensed and deposited. After being cooled the compressed air is admitted to the expansion cylinder; but as it still contains a large quantity of water in solution, which if expansion be carried immediately to atmospheric pressure, would from the extreme cold, be converted into ice, with a positive certainty of causing great trouble in the valves and passages, it is got rid of by a process invented by Mr. Lightfoot, which is not only most efficient in its result, but at the same time very simple in action. Instead of reducing the compressed air at once to atmospheric pressure, it is at first only partially expanded to such an extent as will give a terminal temperature of about 35 deg. Fahr., with the result that almost the whole of the contained aqueous vapour is condensed into water. The partially expanded air which now contains the water as a thick mist, is then admitted into a vessel called the "separator," containing a number of inclined surfaces, through which it passes, parting all the while with its moisture, which gradually collects at the bottom and is blown off.



LIGHTFOOT'S PATENT SELF-CONTAINED DRY AIR REFRIGERATOR.

The area of the surfaces is so proportioned that by the time the air has passed through them, it is quite free from moisture, with the exception of the very trifling amount it can hold in solution at about 35 deg. Fahr. and 30 pounds pressure. The expansion is then continued to atmospheric pressure and the cooled air, containing only a trace of snow is then discharged ready for use in a meat preserving chamber or elsewhere.

The double expansion is carried out in one cylinder, containing a piston and trunk, the primary expansion taking place in the annulus and the final expansion against the whole piston area. To compensate for the varying temperature of the cooling water the cut off valve to the first expansion is made adjustable, and this can either be regulated by hand or it can be made to alter automatically. The temperature in the separator being kept constant under all variations in cooling water, there is an abstraction of moisture to the same degree of dryness whether the machine is at work in temperate climates or in the tropics, and the cold air finally discharged is also kept at a uniform temperature.

The air in expanding, gives back about 50 per cent of the power used in compression, and the difference, plus the friction, must be applied to the machine, either by a steam cylinder acting as that shown in the engraving, or else through gearing or belting. Mr. Lightfoot hopes by some improvements recently made, to reduce the driving power to a considerable exten below what has hitherto been required.

HYDRAULIC MACHINE TOOLS. TWEDDELL'S SYSTEM.

TO compete successfully as a manufacturer, labour-saving tools of the most improved construction are a prime necessity. Those marine engineering firms who are of this opinion will readily recognize the value of the improved flanging machine we herewith illustrate. Flanging by hydraulic power is, we know, not new, but this improved machine on Tweddell's system, as constructed by Messrs. Fielding & Platt, has special and novel features of value.

The usual construction of a hydraulic flanging machine, as hitherto employed, has necessitated the use of expensive dies and blocks, in order to flange the largest plates or boiler fronts at one operation.

The machine we illustrate is modified into the form of a comparatively inexpensive shop tool, which is capable of a very large variety of work.

The largest flanging may be undertaken by successive operations somewhat resembling hand work, and with the use of a block or matrix, representing a small segment of the circle to which the plate or front is to be flanged. The character of the work need not, however, always be circular, but may be oval or to any desired sweep. It is necessary only for a small block to be prepared to suit the required curve. At the same time small circular flanging, such as for the flue openings in the boiler fronts, domes, or any diameters that the gap of the machine will take in, may be effected at one operation by the conversion of the machine into a block and die flanger, as shown in the second figure.

The machine consists essentially of two independent hydraulic rams, C and D. When flanging of large diameter or of an irregular curve is required, the suitable curved block or segment F is bolted to the lower bed-plate, and the plate is clamped in position by the hydraulic head, C. The other hydraulic head D, carrying a special tool, travels downwards in a guide temporarily bolted to the bed-plate, and bends over the edge of the plate as required. If the flanging is to be a circle of large diameter, the plate is carried on a temporarily fixed revolving centre, G, so that the plate can be rotated and all parts of the plate brought in succession under the flanging head.

To perfect the squareness of the flanging, a horizontal ram, E, and head, K, may be fitted in the main standard, which may press home the lower edge of the flange squarely up against the block.

The edge of the plate to be flanged is of course heated in convenient lengths, at present about 4 ft. in extent; but if the furnaces were increased, there seems to be no difficulty in flanging from 5 ft. to 6 ft. in one heat.

When flanging in small diameters is desired, both hydraulic rams are placed in communication with each other, and are united by the circular flanging die, M, as with a cross-head.

A suitable block or matrix, N, is bolted upon the bed-plate, from which the former guide and block has been removed. The circular flanging can thus be effected at one operation.

It is evident that straight flanging can be equally well carried out in this machine, and its capabilities are thus immense and suitable to any class of work, whilst the machine itself is very simple and inexpensive.

The ultimate advantage of such a machine to manufacturers would lie, however, in the economy of work, so we are glad to be able to report that up to now the results have been that the machine does twice the work in a given time, and at half the cost of hand flanging.

It is thought, however, certain that this result will be still further improved. Perhaps some of our readers would wish to be the first to effect this to their own benefit.

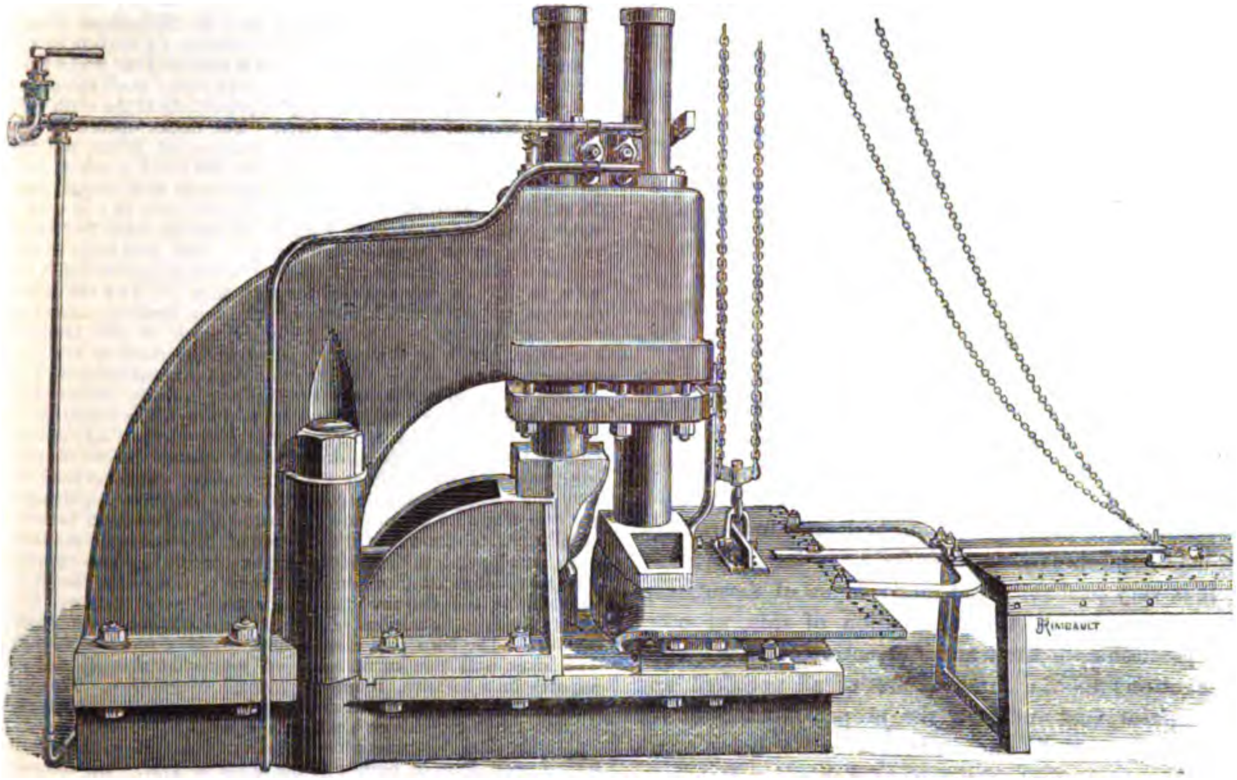
ANTI-FOULING AND ANTI-CORROSIVE COMPOSITIONS.

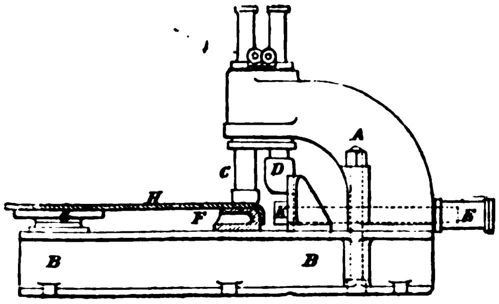
IN our last issue we drew attention to the question of anti-corrosive composition for ships' bottoms, and are in consequence in receipt of information on the subject which will prove, doubtless, of interest to shipowners and others.

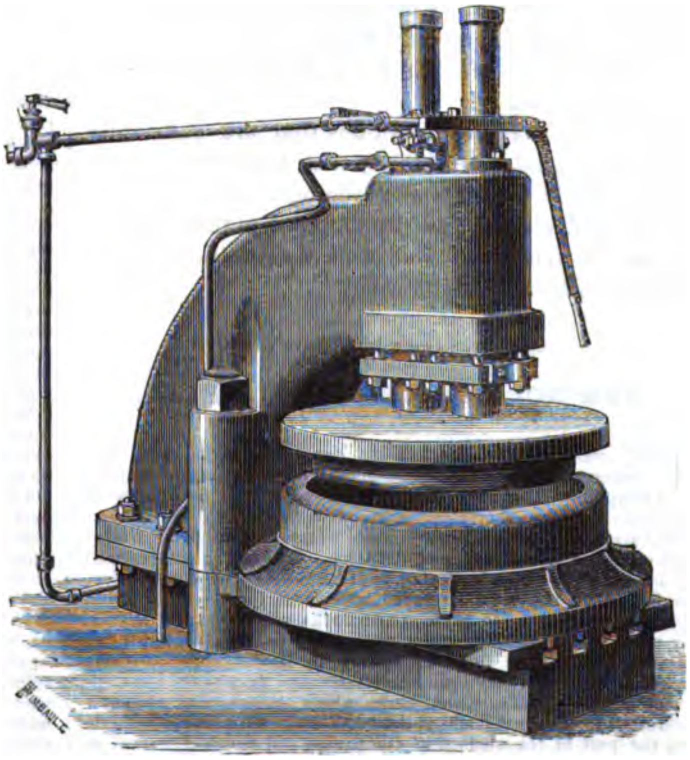
In our present notice we would draw attention to Rahtjen's Patent Anti-Fouling Composition.

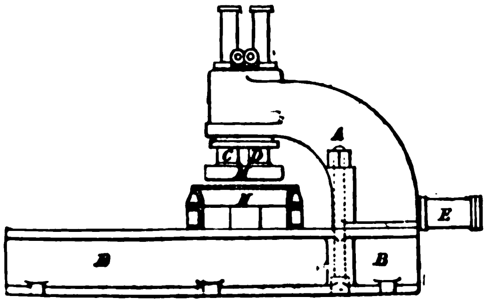
As the same has been in use with a steadily increasing business, since 1865, there must be much to practically recommend it. We find that the great majority of iron steamers have been coated with this composition since its introduction up to the 30th of June, 1880, including the entire fleet of the Peninsular and Oriental Steam Navigation Co., and many other well-known and prominent lines of steamers, both English and foreign.

The advantage arising from any means that will prevent the accumulation of barnacles and grass on the hulls of vessels, is generally well known, with regard to the increased speed thereby obtained, and the economy of coal effected in the case of steamers. It has often been shown that steamers coated with the composition have mostly made much faster pas-









HYDRAULIC FLANGING MACHINE.

sages than before, owing to the smooth slippery surface it has. It is a known fact that on tallow or other greasy surfaces the water clogs and does not run off so quickly as on a smooth, hard surface. Especially on steamers, where the friction is much greater than on sailing ships, it is necessary to have a paint that does not wear away too soon.

We find that Rahtjen's composition will mostly prevent all fouling, except a thin coat of slime, easily removed by washing, for a period of twelve to fifteen months. And even when so long a period as two years has been allowed to elapse before dry docking, as it was the case with the ss. *Faraday*, there is good evidence to prove that very little fouling has occurred that could not be easily removed by scrubbing down, and the body of the paint seems to have stood so well, that the iron was found to be in first-rate preservation. We see that in the case of this composition, as in others, some slight discrimination must be used, and directions attended to in its application.

It is very probable that many cases of dissatisfaction may arise in the application of this, or other compositions, for the want of attention to such simple precautions as the removal first of all perished and loose paint, rust and dirt, the proper stirring of the paint both in cask and in kettles, when being used, and the addition, when required for thinning Rahtjen's composition, of methylated spirit only, and no other substance whatever. Evaporation, also, from a package once opened, and only partly used, will go far to spoil the nature of such a composition when next required for use.

Out of the many compositions that are constantly brought forward, we must say that, from personal enquiries made amongst the leading steamship companies and owners, we have found nothing but a favourable opinion of Rahtjen's composition, which we have selected for attention.

NEW NORTH DOCKS AT LIVERPOOL.

THE commerce of the Mersey develops rapidly, and this necessitates constant additions to the dock accommodation of Liverpool. This necessity is increased by the peculiarity of modern commerce, the vessels engaged in which are to a considerable extent steamers of great length, which require to be loaded and unloaded with the utmost despatch. Hence the construction of long narrow branch docks, with abundance of quay space, supplied with the most approved appliances for the loading and discharge of cargo. In these steam docks vessels do not lie side by side, but in berths by the quay; and as each company has allotted berth space they can collect on their respective quays goods for shipment by their next steamers. It was the development of Liverpool's steam trade which necessitated the new additions to the great docks at the north end. Frequent complaints on the part of the steamship companies, and much agitation in commercial circles, caused the Mersey Docks and Harbour Board, in 1873, to instruct their engineer (Mr. G. F. Lyster) to prepare plans for an extension of the dock system. The plans were prepared, and, after some opposition in the interests of Birkenhead (where the Board also possesses docks), were approved, the shipping and trading community in general objecting to any attempt to compel owners to send their vessels into the Birkenhead Docks. Parliamentary powers were obtained to borrow £4,100,000 on the security of the dock rates, and with this authority the works have since proceeded. These new works comprised dock extensions both north and south of the dock (but principally at the north end) on the Liverpool side of the river. The docks opened by the Prince of Wales, and named by the Princess of Wales, add 110 acres of water space and more than six miles and a half of quay berthing to the accommodation for the trade of Liverpool; and the entrances of these new docks have their sills laid at a level which gives a depth of 23 ft. 7 in. on an average neap tide and of 30 ft. 10 in. on an average spring tide. The advantage of this will be obvious. The general class of vessel using the docks can enter or leave at any state of the tide, thus avoiding the delays, expenses, and risks which have hitherto been incurred. The new docks are situate in Bootle, 3½ miles north of the Liverpool Exchange. It is at the north end where the trade of the great steamship companies is for the most part concentrated, the most modern docks of the Board's estate being already situate there. The entrance to the new dock system is through the Canada Basin in which the tide ebbs and flows, and which forms a sort of vestibule to the most northern docks which existed before the latest additions. But this basin at the mouth of the river has been considerably enlarged and deepened to meet the new requirements, and the width of its entrance from the river has been increased from 250 ft. to 400 ft. On each side of this entrance are being constructed piled timber jetties or piers projecting into the river. These are intended (one on the north side is already completed) to facilitate the entrance and departure of vessels, as well as to assist sluicing operations to keep the entrance clear of silty deposits. The horn pier, already finished, is a remarkable work. The river wall here curves outward somewhat sharply, and terminates in a massive, rounded pierhead of granite. The jetty projects backward from this about 40 ft., and ends in another pierhead of concrete, whence another arm extends to the river wall. The main jetty is supported by enormous posts of greenheart let into a solid base of granite to the depth of 17 ft. On the north end of the horn pier is a small look-out tower, and beside it is an ironwork standard 80 ft. high for the electric light. The entrance to the Canada Basin is in an exposed position, and the peculiar form of the river wall serves to break the force of the waves which dash up against it in stormy weather. On the north side of the Canada Basin are two passages by which the newly-constructed docks are reached. The first is the Langton Dock, with a water area of 18 acres and a quay or berthing space of 4,000 ft. in length. Opening from the eastern side of this dock are two graving docks (each 951 ft. long), which may be subdivided into four docks, each of sufficient extent to accommodate a vessel of the largest class while being repaired or overhauled. On the quay between these graving docks buildings are erected, which contain powerful engines and machinery for pumping the graving docks. Here, also, are powerful engines which supply the motive power that actuates the hydraulic machinery for opening and closing the dock gates, bridges, sluices, working cranes, and other mechanism throughout the new system. Over this great engine-house are a number of dwellings built on the "flat" system for the foreman and engine men. On the quay is also constructed a clock tower 120 ft. high to enclose the accumulator. The group of buildings is in a free Gothic sort of architecture. On the east side of the Langton Dock (and north of the graving docks) is also a branch dock, with three acres of water area and 2,013 lineal feet of berthing space. A hydraulic crane to lift 100 tons is being constructed on the south quay of this branch dock for moving heavy boilers and machinery. On the north side of the Langton Dock are two passages which lead to the Alexandra Dock specially constructed for steamers of vast size, and named after herself by the Princess of Wales. The Alexandra Dock is 1,600 ft. long from north to south, and opening on its eastern side are three branch docks which extend inshore almost to Regent-road, a main thoroughfare which flanks the north docks. These branch docks vary in length from 1,100 ft. to 1,338 ft., and with the Alexandra Dock itself have a water area of 44½ acres, and provide 11,814 lineal feet of quay berthing space for ships. The dock walls are mostly built of cement concrete faced with red sandstone of the district, and with a coping of granite, while the entrance walls are faced with granite. The steps and slips of the graving docks are constructed of granite, but in other respects these docks are built of concrete. All the dock gates are made of greenheart timber, which Mr. Lyster considers the most durable wood for this sort of work. The berthing quays of the new docks are provided with lock-up sheds, 80 ft. to 95 ft. wide, for the protection of cargo in transit, and these sheds directly communicate by road with the city, and by rail with the stations of the several great railway companies who have termini in Liverpool. In the west gable of No. 1 Branch of the Alexandra Dock has been inserted a fine piece of stone carving lately discovered in the interior of the King's tobacco warehouses, at the south end of the docks. It represents the arms of Great Britain before they included the shamrock, and is supposed to have been in the old tobacco warehouses erected in the reign of George III. The arms have been recut, and surrounded with an ornamental border with the Prince of Wales's plumes on each side, and "Alexandra Dock" inscribed on granite below. There is also another granite slab inscribed "These arms of Great Britain in the reign of George III. were removed from an old building on the dock estate, and are re-erected here as a memorial of the auspicious visit of their Royal Highnesses the Prince and Princess of Wales on the occasion of the opening of these docks, September 8, 1881." A floral border round this includes the shamrock absent from the old arms. On the east side of the main entrances by which vessels enter this new group of docks a solid block of buildings—a free adaptation of the domestic Gothic in style—is being erected to provide residences for the dock master, pier masters, gatemen, and other officers. North of the Alexandra Dock is being constructed another new dock with 16 acres of water area and 4,000 ft. of quay berths, but this is incomplete, and needs no further notice at present. The land where the docks have been constructed was purchased many years ago, and, after the completion of the dock mentioned as in progress of construction, 80 acres of the old purchase will yet remain for utilization. The river wall extends to the southern limit of the estate, and in time the promenade, 21 ft. wide, already open for a considerable distance, will extend across Bootle to Seaforth. The whole of the docks northward from the Prince's Dock are completely enclosed either with a wall 14 ft. high or with loftier buildings, thus protecting the ships and quays from depredations.

ON THE PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.*

By Mr. F. C. Marshall, of Newcastle-on-Tyne.

(*Continued from page* 132.)

THE marine boiler of to-day is in all its main features the same as it was ten years ago.

The single-ended boiler, made with two, three, and sometimes four furnaces, is the simplest form, and for all powers under and including 500 indicated horse power is the most generally adopted.

The double-ended form is largely used. It has been found more economically efficient than the single ended form, by as much as 10 per cent. in the writer's own experience. It is generally adopted for engines of large power, but for small powers is inconvenient, owing to its occupying more room lengthwise in the vessel, and also involving two stokeholds, and therefore more supervision. At one time great difficulty was found in keeping the bottoms of boilers of this kind tight. Owing to their length, the unequal expansion due to different temperatures at the top and bottom caused severe racking strains on the bottom seams and rivetting, so severe in some cases as to rend the plating for a large part of the bottom circumference of the shell. This difficulty has now been to a large extent got over, in consequence of the greater attention given to the form and direction of the water spaces in the boiler itself, so as to induce circulation of water; the introduction of the feed water at the top instead of near the bottom; the more careful management now usual on the part of engineers; and lastly, the use of larger plates, welded horizontal seams, drilled rivet holes, and more perfect workmanship throughout.

In boilers having a single flame-box to two furnaces opposite each other, Fig. 7, difficulty has been experienced in keeping the ends of the tubes tight, owing to the action of the one furnace upon the other, and the inequalities of temperature induced thereby. This is now obviated by the introduction of a fire-brick division extending just so high as to prevent the current of air, when the door is opened from striking directly upon the opposite tube-plate.

The modification of double-ended boiler, shown in Figs. 8 and 9, is that introduced by Mr. Alfred Holt. It has many decided advantages, but is costly to make. The formation of the two ends into separate fire-boxes leaves the bottom of the boiler free to adapt itself to the variations of temperature to which it is exposed. The separation of the furnaces from the combustion chamber, excepting through the opening afforded by the connecting tube shown at A, is an advantage in the same direction, and avoids almost entirely the racking strains due to irregular furnace action. The weight of water carried is less, and that of the boiler may also be made less; while the elliptical form of the two ends gives greater steam space.

Figs. 10 and 11 represent a type of boiler largely used in Her Majesty's Navy, and very suitable for all classes of vessels where length is available. It is introduced here as a specimen of a highly efficient boiler in regard to weight and power developed. Many examples have yielded one indicated horse power in the cylinders for every 3 square feet of heating surface, under natural draught and with a very moderate height of funnel; and this with a consumption of fuel not exceeding 2¼ lb. per indicated horse-power per hour under a working pressure of 60 lb. With the aid of a steam jet in the funnel, the heating surface per indicated horse-power has fallen below 2½ square feet. The large water surface afforded for escape of steam secures almost entire freedom from priming, without the incumbrance of steam domes; and the large combustion chamber allows of the thorough combustion of the gases before their passage through the tubes.

The locomotive type of boiler has lately occupied the writer's attention, with a view to its more definite introduction into marine work. In his recent paper before the Institution of Civil Engineers Mr. Thornycroft has shown what can be done with it under a forced draught; and how to reduce the weight of boilers and the water in them, as well as how to get a large power out of a small boiler. This form of boiler (see illustration next No.) affords the opportunity of introducing an almost unlimited amount of absorbing surface in the shape of tubes, while the fire-box is in the best form possible for efficiency. The difficulties, however, which lie in the way of applying the same principles to steamers going long voyages, are very great. The principal difficulty lies in the necessity of burning a large quantity of fuel in a very limited space and time. This can only be done either by direct pressure or exhaust action applied to the furnace. In other words, we must either exhaust the funnel, which will absorb a large amount of power, but would be comparatively easy of application; or our stokers, as is the case with our miners, must work under a pressure of air. The writer would submit for the consideration of the meeting whether this latter is an unreasonable condition of things to contemplate, considering that by so doing we should enormously reduce the dead-weight of our boilers and water, and thereby leave room for a corresponding weight of cargo.

The boiler shown is that known as the Perkins boiler (see illustration next No.) and is introduced here as a specimen of the tubulous system applied to marine purposes. It must be admitted that the tubulous system has not been a success, as actually worked on board ship; the writer, nevertheless, submits that this system affords a means of reducing the enormous weight of boilers and water at present deemed necessary, which is well worthy our consideration; more especially as, with increasing steam pressures, this weight must still further be increased to the serious hindrance of progress, and loss to the shipowner by the displacement of freight-paying cargo.

With regard to the use of steel in marine boilers, the valuable Paper read by Mr. Boyd in 1878, and that read by Professor Kennedy at the last meeting, have left very little to be said as to the character and use of the material, and the mode of treating it. The writer wishes only to state the result of his experience in the manufacture and working of such boilers, with the view principally of removing the doubt and uncertainty, so freely expressed in the discussion on those Papers, and to some extent justified by the failure of the boilers of the *Livadia*. Many steel boilers of sizes varying from 6 ft. in diameter to 14 ft. 6in. in diameter have left the works at St. Peter's since 1877, when the first was made; and in no case has there been a failure of a plate after being put into a boiler, either in the process of manufacture or in working at sea. The mode of working is as follows: For shell plates, from ⅝ in. to ⅞ in. thick, to warm each to a dark red heat before rolling, having previously drilled a few holes to template for bolting the strakes together; the longitudinal seams are usually lap joints treble-rivetted, requiring the corners to be thinned, which is done after rolling. The furnace plates are generally welded two plates in length, and flanged to form Adamson rings, and at tin back end to meet the tube plate; the back flame-box plates are flanged, also the tube plates and front and back plates, and whenever work is put on to the plate it is annealed before going into place. The rivet holes

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* Paper read before the Institution of Mechanical Engineers, at Newcastle.

FIG. 7.

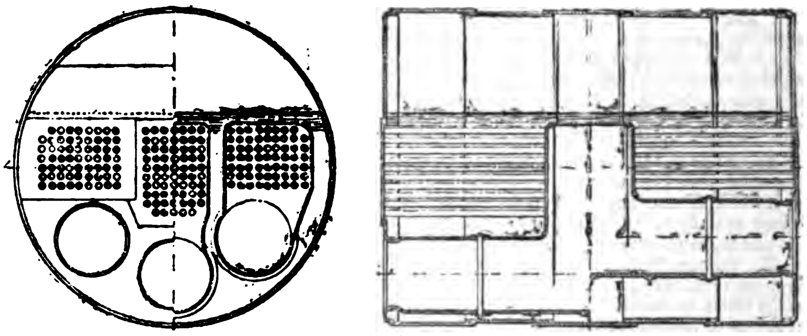


FIG. 8.

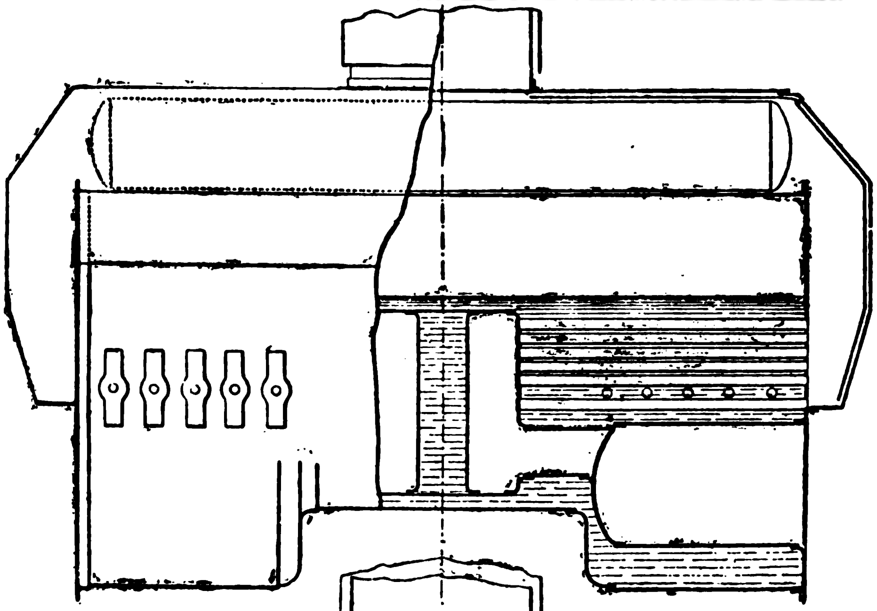


FIG. 9.

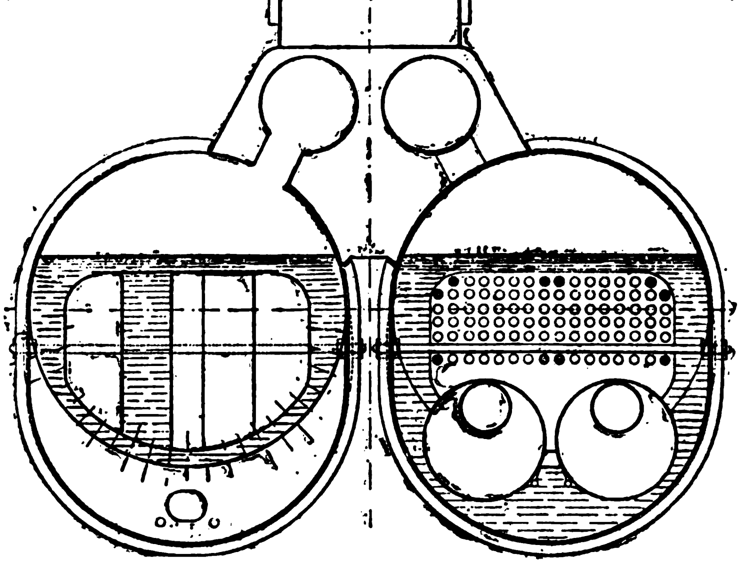
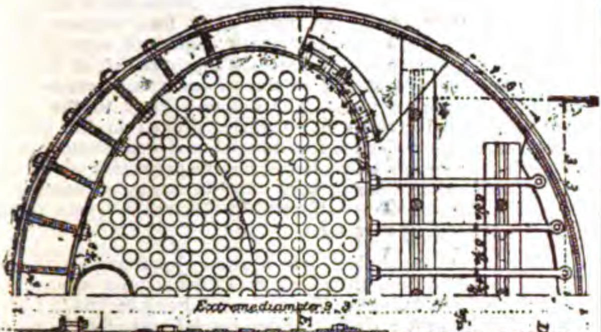


FIG. 10.



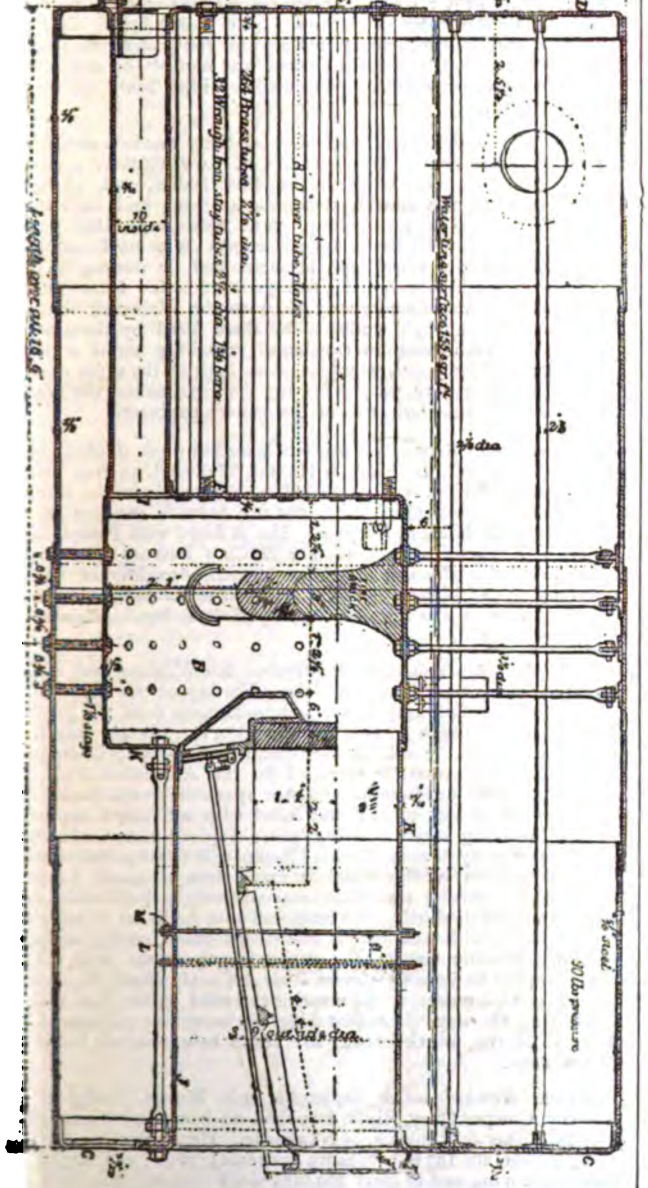

164 Brass tubes 2½ in. dia.
32 Wrought iron stay tubes 2½ in. dia. 1⅜ bore
A. D. over tube plates
Water heating surface 1558 sq. ft.
Length over all 10' 6"
10 inside
2½
2 sets of dia.

FIG. 11.

are drilled throughout. In the putting together the longitudinal seams of the thicker plates of the shells, great care is always taken to set the upper and under plates for the lap to their proper angle before they are bolted together, a point generally overlooked by the practical boilersmith. It will be observed that if this is not done, great strain is thrown on the material, sometimes resulting in fracture. In two boilers, made in another department of the works, fracture actually did take place while closing up the rivetting in four plates ⅝ in. thick; the rivetters having followed the old bad custom, so common in iron boilers, of drawing plates together when in place, in order to close the work the platers should have closed. The writer suggests that this may have been done in other boilers besides those mentioned. The use of steel for boilers is always recommended by the writer, and in no case has he had cause to regret it.

The question of corrosion is one which is gradually being answered as time goes on; and so far very satisfactorily for steel. Some steel boilers were examined a few weeks ago which were amongst the first made; and the superintending engineer reports, "There is no sign of pittting or corrosion in any part of the boiler; the boilers are washed out very carefully every voyage, and very carefully examined, and I cannot trace anything either leaking or eating away. No zinc is used, only care in washing out, drying out, and managing the water."

This is the evidence of an engineer with a large number of vessels in his charge. His statements could be corroborated by many other engineers in similar positions. On the other hand some of our most prominent Liverpool engineers always use zinc, and take care to apply it most strictly. The evidence of one of them is as follows: "We always fix slabs of zinc to most boilers, exposing not less than a surface of 1 square foot for every 20 indicated horse-power, and distributed throughout the boiler. This zinc we find to be in a state of oxide and crumbling away in about three months. We then renew the whole, and find this will last twelve months or more, when it is renewed again. Meantime, we have no pitting and no corrosion, but on the contrary the interior surfaces appear to have taken a coating of oxide of zinc all over, and we have no trouble with them." Again, many engineers have trouble with their boilers under both systems; this is due no doubt to some mismanagement, probably the admission of too much air with the feed water. Frequently, too, the tubes and interior surfaces are destroyed by drops of moisture being allowed to form and dry upon them after blowing out.

The superheating of steam, notwithstanding its undoubted value in all expansion engines, has practically died out. To some extent the use of much higher pressures has rendered it less necessary; but the practical difficulty of the rapid corrosion of the material of which the superheaters were made, and the restrictions imposed by Lloyd's and the Board of Trade on that account, have mainly led to their abandonment.

The most noteworthy feature of to-day in connexion with the marine engine is the demand for largely increased power, to meet the requirements of shipowners for larger vessels and higher speeds. There is a growing feeling amongst them that "speed pays;" and that it is better to insure certainty of arrival at the port of destination than to save a few tons of coal on the voyage. At the same time it is of the first importance that the required increase of speed and power should be achieved, first, with the least possible weight of machinery, water, and fuel to be carried; secondly, with the least possible expenditure of fuel; and thirdly, with safety and efficiency in working, low wear and tear, and cheapness of maintenance.

These points being kept in view, the writer proposes to consider our present marine engine as to its efficiency and capability of further improvement, and then to consider generally in what direction we may look for further developement; carefully separating throughout the boiler, or steam generator, from the engine, or steam user.

(*To be continued.*)

THE Peninsular and Oriental Steam Navigation Company's new steamer *Thames*, which has been built by Messrs. J. & G. Thomson, of Glasgow, was launched from their yard on September 26th. She is 390 ft. long, 42 ft. broad, and 35 ft. deep, with engines of 750 horse power nominal. The vessel will accommodate 120 first and 48 second class passengers, and will carry over 3000 tons of cargo. The first voyage of the *Thames* will be on the Company's Australian line.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Princess.—On August 23rd Messrs. Day, Summers & Co. launched from their building-yard at Northam Iron Works, Southampton, a powerful tugboat for the Bombay Harbour Trust, which was named the *Princess.* This vessel is built of iron, and has the following dimensions:—Length between perpendiculars, 100 ft.; length over all, 104 ft.; beam, 23 ft.; depth from top keel to underside deck, 14 ft. 4 in.; tonnage, B.M., 242 tons. The *Princess* has a straight stem and semi-elliptic stern; she will carry 40 tons of coal in her bunkers, and 60 tons of cargo in her hold. She has a large forecastle forward and cabin accommodation for the captain and engineer aft, also a steam windlass. In order to give the greatest facility for handling this vessel, it was decided by her owners to adopt the twin-screw principle of propulsion, and she will therefore be fitted with two distinct and separate pairs of engines, each of 60-horse power nominal. These engines are compound, with cylinders of 20 and 40 in. diameter, with 24-in. stroke, and fitted with steam starting gear. The propellers have each four blades, and are 8 feet diameter, with a pitch of 14 feet.

Lismore.—On August 25th Messrs. W. Johnstone & Co., of Liverpool, launched at the yard of the Barrow Shipbuilding Company, a steamer of 4040 tons. She is registered of Barrow, and is intended for the cattle trade. Her length between perpendiculars is 376 ft.; extreme breadth, 42 ft.; depth of hold, 26 ft. with engines, indicating 2550 horse-power. She is fitted with a direct steam windlass by Messrs. Emerson, Walker & Co., London.

Hasland.—On August 27th Messrs. W. Gray & Co. launched from their yard at West Hartlepool an iron screw steamer of the following dimensions:—Length, 256 ft. 6 in.; breadth, 34 ft. 6 in; depth in hold, 19 ft. 8 in. She has been built to the order of Messrs. Groves & M'Lean, of West Hartlepool, and is intended for the American, Mediterranean, or Indian trade, and is 1,750 tons register. She is fitted with engines of 150 horse-power by Messrs. T. Richardson & Son, of Hartlepool, and has all the latest improvements, including four steam winches by Clark, Chapman, & Gurney, and patent windlass by Emerson & Walker. On leaving the ways the vessel was named the *Hasland*, the christening ceremony being performed by Mrs. James Groves, Billingham.

Harbinger.—On August 27th there was launched from the yard of the Sunderland shipbuilding Company (Limited) an iron screw steamer, built to the order of the Harbinger Steamship Company, which is managed by Mr. John L. Browne, John-street, Sunderland. The vessel has short full poop, raised quarterdeck, bridge, and topgallant forecastle, and is of the following dimensions:—270 ft. by 37 ft. by 20 ft. 6 in. with engines of 170-horse power, which are supplied by the North-Eastern Marine Engineering Company (Limited). The vessel is fitted in every detail with the latest improvements for rapid loading and discharging, having special arrangements for the carriage of grain cargoes, and is supplied with four steam winches by Messrs. Clarke, Chapman, & Gurney, Harfield's patent windlass, &c., &c. The vessel was named *Harbinger* by Mrs. Browne, wife of the managing owner.

ON August 27th there was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), of Willington Quay, on Tyne, an iron screw steamer, of the following dimensions, viz.:—Length between perpendiculars, 287 ft.; breadth extreme, 37 ft.; and depth, 23 ft. 6 in. The vessel has been built to the order of Messrs. Joseph Robinson & Co., of North Shields. She is fitted with all modern appliances, including Tyzack's patent anchor.

Raleigh.—On August 27th Messrs. Caird & Purdie, the firm of shipbuilders, who have recently commenced operations at Barrow, launched an iron steamship for Messrs. Holman & Sons, London, and which is intended for the Baltic trade. The new vessel is 245 ft. in length, 34 ft. broad, and has a depth of hold of 17 ft. Her tonnage being about 1,100 tons. Messrs. Westray, Copeland & Co. will supply the engines, and Emerson, Walker & Co. the Patent Windlass. The Company have at present three vessels on the stocks, and trade prospects are very good.

Velasco.—On August 27th the Royal Spanish iron cruiser, *Velasco*, was launched from the yard of the Thames Iron Works and Shipbuilding Company, Blackwall. The vessel is the second iron cruiser built from the same design by this company for the Spanish navy, and similar vessels are now in course of construction in some of the royal dockyards in Spain. She is 210 ft. long, 32 ft. beam, and 16 ft. deep, and 1,039 23-94 tons burthen, British measurement. She will be fitted with engines of 1,500 indicated horse-power by Messrs. Humphreys, Tennant & Co., of Deptford. Her armament will consist of three 6-in. 4 ton breech-loading new type Armstrong guns. The *Velasco* belongs to the type of fast unarmoured cruisers now largely adopted in the principal European navies, which are found useful on distant stations in time of peace, and are specially adapted for the protection of the Commercial Marine in time of war. The ceremony of naming and launching the vessel was performed by Senora De Ojeda, and the launch was perfectly successful.

Abeja.—On September 3rd Messrs. John and William B. Harvey launched from their yard at Littlehampton a wood-built schooner, of the following dimensions:—Length, 100 ft.; beam, 23 ft.; depth, 12 ft.; classed under special survey 13 A 1. She was built to the order of Messrs. Olano Larrinaga & Co., of Liverpool and Bilbao, and is intended for the Philippine Island trade. On leaving the ways the vessel was named the *Abeja*, the christening ceremony being performed by Miss Mary Gales, of Littlehampton.

Maha Vajirunhis.—On September 6th there was launched from the yard of Messrs. C. Mitchell & Co., Low Walker, a screw steamer built for local trade in the East Indies, and, as light draught of water is a consideration, she has been built entirely of steel. The vessel is 250 ft. long, 32 ft. beam, has a full poop, which will be fitted for first-class passengers in a most complete manner, and as the vessel will, as mentioned, be trading in the East, her upper deck with all its fittings are of teak. Immediately after the launch the steamer was taken to the Wallsend Slipway Engineering Company's works, to be there fitted by them with powerful compound engines capable of propelling her at a speed of 12 knots. The vessel, which has been built to the order of Mr. H. Katz, of Singapore, was, on leaving the ways, named the *Maha Vajirunhis* by Mrs. Park, wife of the owner's engineer.

Brunette.—On September 6th was launched from shipbuilding-yard of Messrs. C. S. Swan & Hunter, Wallsend, an iron screw steamer, built for Th. Rodenacker, Esq., of Dantzic, of the following dimensions:—Length, B.P., 202 ft.; breadth extreme, 28 ft. 6 in.; depth of hold, 15 feet 6 in. She is fitted with Patent Cone Brake Windlass—Emerson, Walker & Co.'s Patent. The vessel was named the *Brunette* by Miss Hassell, daughter of G. C. Hassell, Esq., of Newcastle, and proceeded to the crane to receive her machinery of 110 horse-power, by Messrs. Black, Hawthorn & Co., Gateshead.

Gulf of Carpentaria.—On September 8th William Gray & Co. launched from their yard at West Hartlepool an iron screw steamer of the following dimensions:—Length over all, 300 ft.; breadth, 38 ft.; depth to spar deck, 27 ft. 3 in.; classed 100 A 1 Lloyd's; built to the order of the Greenock Steamship Company, Greenock. This vessel is intended for the Australian trade, to carry 3,500 tons deadweight, and has spacious 'tween decks for carrying horses and cattle; and fitted with all recent improvements, including steam steering gear, Napier's steam windlass, steam winches by Messrs. Clarke, Chapman & Gurney, Newcastle. The construction of the vessel is extra strong, beyond Lloyd's requirements, having two additional water-tight bulkheads, and topside strakes doubled. The main and spar decks are of iron, the latter covered with teak, and is double-bottomed, on the cellular system, for water ballast, the entire length of the ship. The engines are to be fitted by Messrs. Blair & Co. (Limited), Stockton, and are of high power, as the vessel is intended to be a fast sailer. On leaving the ways the christening ceremony was performed by Mrs. A. Morris, of Greenock, the vessel being named *Gulf of Carpentaria.*

Baines Hawkins.—On September 9th Messrs. Hodgson & Soulsby, Cowper Quay, Blyth, launched an iron screw steamer for Messrs. Fisher & Renwick, of Newcastle. Her dimensions are:—Length over all, 197 ft.; breadth (extreme), 30 ft.; and depth of hold, 13 ft. 9 in., and to carry 300 tons dead weight. She will be engined by Messrs. Hawks, Crawshaw & Co., of Gateshead, with engines of 90 nominal horse power, with cylinders of 48 in. and 24 in. diameter. She is called the *Baines Hawkins.*

Chrysolite.—On September 10th Messrs. M. Pearse & Co launched from their iron shipbuilding yard at Stockton an iron screw steamer, named the *Chrysolite*, of the following dimensions, viz.:—Length between perpendiculars, 250 ft.; extreme breadth, 34 ft.; depth of hold to top of floors, 22 ft. This vessel is about 1,600 tons gross register, is classed 100 A 1 at Lloyd's, and has been built under special survey. She has a short full poop, long bridge-house amidships, and topgallant forecastle. Her main and upper decks are of iron, and she has double bottom for water ballast, is schooner-rigged, with double topsails on the foremast. She is furnished with four double-cylinder steam winches, steam steering gear, and is replete with all the latest and improved appliances for expeditiously loading and discharging cargoes. The engines for this vessel, which are on the compound direct-acting principle, are of 130-horse power, and from the well-known establishment of Messrs. Blair & Co., of Stockton. The steamer is built for Messrs. W. Talley & Co., of Hull, and is the third of four which the owners have ordered from Messrs. M. Pearse & Co.

Westwood.—On September 10th there was launched from the shipbuilding-yard of Messrs. Robert Thompson & Sons, Southwick, an iron screw steamer, built to the order of David Wilson, Esq., of Hull, of the following dimensions, viz.:—Length, 240 ft.; breadth, 34 ft.; depth of hold, 17 ft. She has been constructed under Lloyd's special survey to class 100 A 1, having long quarter deck extending to after end of bridge, with cabin fitted up under bridge for captain and officers, and accommodation at side of engine-room for engineers and petty officers, also for firemen and crew in topgallant forecastle. Her arrangements and fittings throughout are of the most recent and best, and she is intended to carry a large cargo on medium draught. She is fitted with four steam winches and donkey boiler by Messrs. Clarke, Chapman & Gurney, Gateshead, Harfield's patent windlass, anchor crane, patent midship steering apparatus, patent screw gear aft, &c., &c. The engines for the vessel are being made by Messrs. C. D. Holmes & Co., Hull, and are of 120-horse power. As the vessel left the ways she was named the *Westwood* by Mrs. Laws, wife of Captain Laws, who takes command.

Anerley.—On September 8th there was launched from the shipbuilding yard of Messrs. Blumer & Co., North Dock, Sunderland, an iron screw steamer of the following dimensions:—Length, 270 ft.; breadth, 37 ft.; depth of hold, 24 ft. 6 in. This vessel has been built to the order of Messrs. Watts, Ward, & Co., London and Newcastle-on-Tyne, and is the fourth vessel these builders have built for the same owners. She is of the highest class at Lloyd's, and is being fitted with all the latest improvements. As the vessel left the ways she was christened the *Anerley* by Miss Robinson, of Birmingham.

Wydale.—On September 10th a new steamer named the *Wydale* was launched from the yard of Messrs. John Redhead & Co., at South Shields. Her length is 275 ft., beam 36 ft., and depth 23 ft. She is to carry 2,000 tons deadweight, and will have engines of 185-horse power at 80 lbs. pressure. She will be fitted with Harfield's patent windlass, patent steam steering apparatus, and all other modern appliances. The vessel is intended for the Atlantic and general trades, and the owners are Messrs. Pantland, Hick & Co., of Scarborough.

Mount's Bay.—On September 10th Messrs. Schlesing, Davis & Co. launched from their building-yard at Wallsend a steamer named the *Mount's Bay*. This vessel has been built to the order of the Mount's Bay Steamship Company (Limited), of Penzance, the managers of which are Messrs. F. Banfield & Son. The *Mount's Bay* is a spar-decked vessel of the following dimensions:—Length between perpendiculars, 290 ft.; breadth, 37 ft.; and depth moulded, 28 ft. 6 in. Classes 100 A 1 at Lloyd's, and has been built under special survey. It is estimated she will carry over 3,000 tons deadweight. Her engines are being constructed by Messrs. Black, Hawthorn, & Co., of Gateshead, and are of the compound surface-condensing description, the cylinders being 37 and 70 in. in diameter, with a stroke to each of 45 in. It is calculated this power will drive the vessel at a speed of at least 10 knots an hour. The main deck of the vessel is of iron, and the spar deck of wood. She has four separate holds, the cargo from which will be discharged by four powerful steam winches, to be fitted by Messrs. J. Smith & Sons, of Newcastle. The winches will be worked either by a large donkey boiler or from the main boiler, as may be preferred. The holds have also arrangements by double stanchions from deck to ceiling for dividing the ship longitudinally to adapt her for carrying grain in bulk. The water ballast tanks are under the fore, main, and after holds, and will contain sufficient water to enable the vessel to steam with holds quite empty. One of Messrs. Donkin and Nichol's steam steering gears will be fitted on the bridge, and a powerful screw gear aft. The cabin arrangements for passengers and officers are aft. One of Harfield's patent steam windlasses is supplied for working the anchors and cables. On the vessel leaving the ways the ceremony of naming her was performed by Mrs. John Canfield.

Westergate.—On September 12th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw steamer of the following dimensions, built to the order of Messrs. Weatherley, Mead, and Hussey, London:—Length between perpendiculars, 260 ft; breadth, 36 ft.; and 20 ft. depth of hold, with a deadweight carrying capacity of about 2,450 tons. She is classed 100 A 1 Lloyd's Register, and is constructed with a short full poop for accommodation of officers, raised quarter deck from poop to bridge, bridgehouse amidships, and topgallant forecastle for accommodation of crew; water ballast in main and after holds and peaks; four steam winches and donkey boiler, by Clarke, Chapman, and Gurney, Gateshead; Harfield's windlass; Bow, M'Lachlan, & Co.'s steam steering gear, and all the latest improvements. On leaving the ways, the vessel was named the *Westergate*, the ceremony of christening being performed by Miss Fowler, daughte of Captain Fowler, who will take command. The vessel was taken in tow for Hartlepool, where she is to be fitted with engines of 160-horse power by Messrs. Thomas Richardson & Sons, with all their latest improvements in marine engineering.

Marima.—On September 21st Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer built for Messrs. Steel, Young & Co., of London and West Hartlepool. This vessel is No. 100 in the builders' books, and is the 18th steamer they have built for the same owners. Her principal dimensions are:—Length by perpendiculars, 257 ft. 6 in.; beam extreme, 34 ft. 6 in.; depth, moulded, 20 feet 4½ inches. She has topgallant fore-castle, bridge house, long quarter-deck, and a short poop over the cabin; has double bottom all fore and aft for water ballast, constructed on the cellular system. The decks, chart-house, engine skylight, cabin companion and skylight, as also the main rail, are built of iron. She will be fitted with four steam winches, donkey boiler, and Emerson, Walker & Co.'s patent windlass, and will be rigged as a double topsail schooner. She has been built under Lloyd's special survey for the 100 A 1 class, and will be fitted with engines of 150-horse power by Messrs. T. Richardson & Sons, of Hartlepool Iron Works. On leaving the ways the steamer was christened *Marima* by Miss Forster, of Darlington.

St. Ronan.—On September 21st a steamer was launched by Earl's Shipbuilding Company from their building yard at Hull. She is intended for the Atlantic cattle and grain trade, and is built for Messrs. Rankin, Gilmour & Co., Liverpool. She was named the *St. Ronan*, and is of the following dimensions:—Length, 402 ft.; breadth, 43 ft.; depth, 34 ft.; gross tonnage, 4,600 deadweight; capacity, 5,000 tons. She is an awning-decked ship, and is built even of greater strength than the A 1 Lloyd's Rules require. She will be propelled by engines of 500-horse power nominal, and expected to develop 2,400 tons, which will drive the ship 12 knots Steam is supplied by three large steel boilers.

Ada.—On the afternoon of September 26th there was successfully launched from the ship-building yard of Messrs. Robert Thompson & Sons, Southwick, an iron screw-steamer named the *Ada*, built to the order of Messrs. Turner, Edwards & Co., of Bristol, of the following dimensions, viz.:—Length, 220 ft. breadth, 30 ft., and depth, 15½ ft. She has been constructed under Lloyd's Special Survey to class 100 A 1, having a long quarter-deck, short, full poop, with accommodation for captain and officers, top-gallant and forecastle for crew, and short bridge amidships for engineers. Her arrangements and fittings throughout are of the most recent, and she is built on the web frame and shelf plate system in hold, instead of hold-beams for the stowage of cargo; and on the cellular bottom principle, with plate steel. She is fitted with steam winches and donkey-boiler by Messrs. R. Roger & Co., Stockton, Harfield's patent windlass, anchor crane, patent midship steering apparatus, patent screw-gear aft, &c. She will be fitted with engines of 90 nominal horse-power by Mr. George Clark, of Southwick.

LAUNCHES.—SCOTCH.

Lamington.—On August 23rd there was launched from the yard of Messrs. Robert Duncan & Co., Port Glasgow, a screw-steamer of about 2,000 tons gross register, and 3,000 tons dead weight capacity for the firm of Messrs. Renton & Co., Glasgow, for general trading purposes. Dimensions 275 by 37 by 23, classed 100 A 1 at Lloyd's, and 20 years in red in Liverpool Register. This vessel has been specially designed for a cargo boat, and has accommodation for a small number of passengers. She has been built of great strength, with double bottom on the cellular principle fore and aft, and is one of the first vessels of her particular type constructed on the Clyde. She was named *Lamington* by Mrs. Renton, wife of the Managing Owner, and immediately after the launch was towed to Greenock to receive her engines of 200 nominal horse power, from the firm of Messrs. Rankine & Blackmore. On completion, she will proceed to London and be loaded for Adelaide, Melbourne, and Sydney, by Messrs. W. Gracie & Co., and Messrs. Ismay, Imrie, & Co. The steamer will be commanded by Captain F. L. Burkill, late of the *Lindores Abbey*, belonging to the same firm.

Prins Alexander.—On August 24th a screw steamer of 3.100 tons, was launched by Messrs. John Elder & Co., at Fair field. Her principal dimensions are as follow:—Length between perpendiculars, 350 ft.; breadth 32 ft.; depth, moulded, 30 ft. 9 in. Miss Vichoff, of Paris, named the vessel *Prins Alexander.*

Pen Douran.—On August 25th Messrs. Henry Murray & Co. launched from their Kingston yard a four-masted iron sailing barque of about 1,900 tons register. Her dimensions are:—Length between perpendiculars, 270 ft.; breadth of beam moulded, 40 ft.; depth of hold from the top of ceiling, 23 ft. 8 in.; and she classes in Lloyd's highest grade. She is fitted with Emerson, Walker & Co.'s patent double-purchase Capstan windlass, and built for the Ben Line, of which Messrs. Watson Bros., of Glasgow, are the owners. The vessel was named the *Ben Douran* by Miss Bessie Watson, daughter of John E. Watson, Esq. After completing her outfit in Port-Glasgow Harbour she will load coal there for San Francisco.

Mindanao.—On August 26th Messrs. H. M'Intyre & Co. launched from their shipbuilding yard at Merksworth, near Paisley, an awning-deck screw-steamer of 1,200 tons gross register. She is built for Captain William Watt, of Helensburgh, and is intended for local trade in the East. She will be fitted with a pair of engines of 700 indicated horse-power by Messrs. Hutson & Corbett, of Glasgow. As she left the ways she was named the *Mindanao* by Mrs. Watt, wife of the owner.

Marquis de Valuma.—On August 27th there was launched from the shipbuilding yard of Messrs. D. Allan & Co., at Caroline Park, Granton, this vessel, the dimensions of which are 92 ft. in length, 17 ft. 6 in. in breadth, and 8 ft. 6 in. in depth. She is another of the fleet which is being built for the Spanish Fishing Company in Madrid. The engines of this steamer have been supplied by Messrs. Walker, Henderson & Co., Glasgow, and are of the newest compound principle. The steam trawling, which is a new industry in Spain, is now being rapidly developed. A vessel of larger dimensions is now being built by Mr. Allan for the Forth Fishing Company. The steam trawling in the Firth of Forth is now being greatly increased, and is superseding the old system of fishing. During the past few months these trawlers have been paying fully 50 per cent. It is believed that in a few years trawling will entirely supersede the line fishing.

Craignair.—On August 27th Messrs. Dobson & Charles launched from their shipbuilding yard, at Grangemouth, an iron screw steamer, built to the order of Messrs. T. Biggar & Sons, Dalbeattie, of 170 tons, and of the following dimensions:—90 by 18 by 8. She will be supplied with engines of 30-horse power by Messrs. R. H. Pearson & Co., Glasgow. As she left the ways the ceremony of naming her the *Craignair* was performed by Miss M. Alley, Falkirk.

India.—On August 27th Messrs. Wm. Denny & Brothers launched from their shipyard at Dumbarton a steel screw steamship of the following builders' dimensions:—390 by 42 by 31, and of about 4,100 tons gross, for the British India Steam Navigation Company. She has been built to class 100 A 1 at Lloyd's, under special survey, and is to be fitted with a pair of compound surface-condensing direct-acting inverted cylinder engines, of 495-horse power nominal, by Messrs. Denny & Co., Dumbarton. She is fitted for a large number of first-class passengers, with all the comforts usual in first-class passenger steamers. As the steamer left the ways she was named the *India* by Miss Sarah M'Naughton, daughter of J. M'Naughton, Esq., Secretary of the British India Steam Navigation Company.

Condor.—On August 27th Messrs. Dobie & Co. launched from the Govan Shipbuilding yard an iron screw-steamer, built by them for the Cork Steamship Company (Limited), of Cork, to the highest class, and measuring about 1,100 tons gross. As she left the ways she was named *Condor* by Mrs. Young, Newstead-house. The engines are being supplied by Messrs. James Jack & Co., engineers, Liverpool, and direct-steam windlass by Emerson, Walker & Co., patentees, London.

Bengore Head.—On August 25th an iron screw steamer, named the *Bengore Head*, was launched from the shipbuilding yard of Messrs. A. & J. Inglis, Point-house, Glasgow. . The steamer is for Belfast owners, having been built to the order of the Ulster Steamship Company (Limited), of which Messrs. G. Heyn & Sons, Ulster-chambers, Belfast, are the managers, and will be engaged in the American, Eastern, and other long-voyage trades. The dimensions of the *Bengore Head* are:—Length, 352 ft.; breadth, 40 ft.; and depth, from top of ordinary floors to spar deck, 32 ft. 1 in.; about 3,386 tons gross, and 2,210 tons nett register; with a total carrying capacity of about 4,900 tons. The engines, to be supplied by the same firm, are on the compound surface-condensing principle, with all the latest improvements; cylinders 40 and 77 in., with 54-in. stroke; 400 nominal horse-power. Steam will be supplied from two large double-ended steel boilers, with large heating surface, and of superior construction for a working pressure of 85 lbs.; also, a large auxiliary boiler, to be used in conjunction with the main boilers, or separately, for driving winches, &c., in port. The hull is built to Lloyd's 100 A 1 class, spar deck rules, with extra heavy scantling, upon the longitudinal bracket system, having a double bottom extending fore and aft, fitted for 700 tons water ballast in four compartments, with extra strengthening throughout. There are three iron decks laid, the upper one covered with wood, flush upper deck, with substantial shelter house 80 ft. long amidships, completely protecting engine-room skylights, gratings, and houses. The accommodation for crew is forward, engineers amidships, and captain, officers, &c., in cabin aft. The steamer will be schooner-rigged, with two masts, has five large hatchways, and will be fitted with steam steering gear, steam windlass, five powerful steam winches, and other facilities for the rapid loading and discharge of cargo. The ceremony of naming the ship was performed by Miss M'Dowell, niece of Mr. Alexander M'Laine, the chairman of the company. The steamer will receive her outfit and machinery at the yard of the builders, and was expected to be ready for sea before the end of September. The *Bengore Head* will be the largest vessel registered and owned at the port of Belfast, and is a valuable addition to the Head Line of the Ulster Steamship Company. She will be commanded by Captain Thomas M'Calmont, late of the *Black Head* (s), belonging to the same owners.

Cameo.—On August 31st Messrs. Alex. Stephen & Sons launched from their yard at Linthouse, Govan, an iron screw steamer of about 2,400 tons, classed 100 A 1 at Lloyd's, and built for Messrs. Tellefsen, Wills, & Co., Cardiff. This vessel is fitted with Emerson, Walker & Co.'s Patent Windlass, steam steering gear and every appliance for convenience and efficiency in working the ship and cargo. The engines (also made by Messrs. Stephen) have cylinders 35 and 65 in. diameter by 42 in. stroke, and a working pressure of 80 lbs. The vessel was named the *Cameo* by Miss Stephen, of Broughtyferry.

St. Andrew.—On September 1st the *St. Andrew* (s), another of the steamers building for the Channel Line (Murray Brothers & Co., managers) by the London and Glasgow Shipbuilding and Engineering Company (Limited), was launched from their building-yard at Govan. The vessel is about 600 tons builders' measurement, with compound condensing engines of 100-horse power, and is intended to carry on the trade along with her sister ship the *St. George*, between Glasgow and London, *via* Littlehampton, calling at Greenock, Larne and Dublin. The ceremony of naming the vessel was performed by Miss Mary Bruce Murray. The *St. Andrew* is expected to be ready for the berth in three weeks, and regular weekly sailings will thereafter be maintained.

Opal.—On September 7th there was launched from the ship-building-yard of Mr. W. B. Thomson, Dundee, an iron screw steamer named the *Opal*. Her dimensions are as follows:—Length, 218 ft.; breadth, 30 ft.; depth of hold, 15 ft. 6 in.; gross tonnage, 1,126; horse power of engines, 110. The *Opal* (s) will be under the management of Mr. P. M. Duncan, of Dundee, and will be commanded by Captain Douglas, formerly of the *Amethyst*. She is intended for the Baltic and Mediterranean trades.

City of Calcutta.—On September 8th Messrs. Charles Connell & Co. launched from their yard at Scotstoun the *City of Calcutta*, an iron screw steamer of 3,900 tons gross. This, the latest addition to Messrs. George Smith & Sons' City Line of steamers, is also their largest vessel, and has been built with a number of extras beyond Lloyd's requirements for their highest class. The accommodation for saloon passengers is provided in a large deckhouse amidships, occupying the whole width of the vessel before the engine-room, the crew being accommodated aft below the upper deck. All the latest improvements have been fitted on board for discharging and loading cargo. The new steamer is 400 ft. long, 42 ft. broad, and 31 ft. deep, and when completed her engines are expected to develop a high rate of speed. She is the first of three new steamers for the line to replace three lately sold, which were found to be too small for Messrs. Smith's Calcutta trade. The other two, of somewhat similar dimensions, are under construction in the yards of Messrs. Barclay, Curle & Co., and Messrs. Workman & Clarke, Belfast. As she left the ways she was named by the wife of Captain Robertson, who is to command the vessel.

Heather Bell.—On September 8th, Messrs. T. B. Seath & Co., Rutherglen, launched an iron steam yacht of 300 tons burthen for Mr. H. Robertson Washley, of Peterborough. The vessel was named *Heather Bell* by Miss A. M. Seath.

Loch Moidart.—On September 8th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Whiteinch, a four-masted sailing ship of 2,000 tons register and 3,500 tons deadweight carrying power, for the General Shipping Company, managed by Messrs. Aitken, Lilburn & Co. She was, on leaving the ways, named the *Loch Moidart* by Mrs. James Arthur, of Barshaw, wife of one of the owners. She is launched for the California and Calcutta trades, has been built to the highest class at Lloyd's, with all the most modern improvements.

Victoria.—On September 9th, Messrs. Aitken & Mansel launched from their Whiteinch yard a saloon paddle-steamer, 190 by 25 by 9. This vessel, which was named *Victoria*, is built of steel, and is completed in the best style for passenger accommodation. She is owned conjointly by the London and South Western and the London, Brighton, and South Coast Railway Companies, and will be employed chiefly in their passenger service between Portsmouth, Ryde and Stoke's Bay. The engines are being fitted by Mr. David Rowan, of Glasgow, and are adapted to obtain a high speed. This vessel has been constructed by the joint companies to secure a more expeditious service for their passenger trade to the Isle of Wight.

Banner.—On September 9th an iron screw steamer of 353 tons and 55 horse-power, built for the coasting and Channel trade, and named *Banner*, was launched by Messrs. John Fullerton & Co., at their yard, Merksworth, Paisley. She is for James R. Currie, Esq., Paisley.

Lake Huron.—On September 10th a new Beaver Liner was launched from the shipbuilding yard of the London and Glasgow Engineering and Iron Shipbuilding Company at Govan. The vessel was named the *Lake Huron* by Miss Winnie Rintoul, of Langbank, and is a screw steamer of over 4,000 tons, being the fourth steamer built by the same firm for the Canada Shipping Company, Limited (Beaver Line). She is 385 ft. long by 42 ft. 6 in. beam by 31 ft. 6 in. to spar deck, and is classed 100 A 1 (three decks) at Lloyd's. She is fitted with steam steering gear, steam winches and windlass; while all other modern improvements have been introduced. The engines are compound surface-condensing of the most improved description, and are 3,000-horse power indicated. The Canada Shipping Company were amongst the first engaged in the cattle-carrying trade between this country and Canada and the United States. This ship has been fitted up specially for this trade, combining all the improvements that the experience of the company have gathered during the last few years. Special attention has also been exercised in the ship's fittings in order to adapt her for the increasing emigrant trade between this country and Canada and the United States, everything having been done to contribute to the comfort, convenience and safety of this class of passengers.

Closeburn.—On September 10th Messrs. Russell & Co., Greenock, launched an iron barque named the *Closeburn*, after the model of the *Peebleshire*, and of the following dimensions:—Length, 200 ft.; breadth of beam, 32 ft. 6 in; depth of hold, 19 ft. 6 in.; of 900 tons register, and to carry about 1,480 tons deadweight. The *Closeburn* has been built for Messrs. Macdonald, Hood & Co., Glasgow, and is intended for the Sydney trade.

Solway.—On September 20th Messrs. Barclay, Curle, & Co. launched from their shipbuilding yard at Whiteinch a new steamer named the *Solway*, for Messrs William Sloan & Co., to be employed by them in the passenger and cargo trade between the Clyde and the Bristol Channel. The new vessel is 220 ft. long, 30 ft. broad, and 15 ft. 3 in. deep. She has been fitted up with many of the latest improvements, including water ballast in three separate tanks, and has the highest classification at Lloyd's. She is to be schooner rigged, and fitted with a pair of surface-condensing compound engines to drive her at a good rate of speed. She will also be fitted with Napier's patent steam windlass, Bow & M'Lachlan's steam-steering gear, three steam winches, and a couple of steam cranes by Muir & Caldwell. The ceremony of naming her the *Solway* was performed by Miss Sloan.

Ossian.—On September 21st Messrs. H. M'Intyre & Co. launched from their shipbuilding-yard at Paisley, the *Ossian*, an iron screw steamer of 800 tons. The *Ossian*, which has been built by the London and Edinburgh Shipping Company, is classed 100 A 1 at Lloyd's, and fitted up as a first-class cargo steamer. The engineers are Messrs. Hutson & Corbett, Glasgow. The ceremony of naming was performed by Miss Helen Madeline Usher, of Edinburgh.

Valdivia.—On September 22nd Messrs. John Reid & Co., Greenock, launched a steel barque named the *Valdivia*, of 900 tons. The *Valdivia* is a sister ship to the *Bolivia*, launched about a month ago by the same firm, both vessels having been built for Messrs. Nicolson & M'Gill, Liverpool.

Benlarig.—On September 22nd Messrs. Alexander Stephen & Son launched from their yard at Linthouse, an iron screw steamer of the dimensions 310 by 38 by 25, built under special survey to highest class in Lloyd's, and named the *Benlarig* by Mrs. Mitchell, wife of Lieutenant-Colonel Mitchell, Tillicoultry House. This is the second steamer built by Messrs. Stephen to the order of Messrs. Wm. Thomson & Co., Leith, for their Ben Line of London and China clippers. Her engines, which are also of Messrs. Stephen's construction, and were fitted on board before launching, are on the compound surface-condensing principle, and of 300-horse power nominal, the boilers being very ample, and suitable for working at 85 lbs. pressure.

Lamprey.—On September 22nd Messrs. Blackwood & Gordon, Greenock, launched from their yard a screw steamer of the following dimensions:—Length, 155 ft.; breadth of beam, 24 ft.; depth of hold, 14 ft. This steamer, which was named the *Lamprey*, has been built for Mr. John Burns, and is to be engaged in the passenger trade between Larne and Greenock.

LAUNCH.—French.

La Ville de San-Nicolas.—On August 18th there was launched from the shipbuilding yard of Forges and Chantiers de la Mediterranée at La Seyne (Var), under the experienced management of Mr. Lagane, an iron screw steamer built for the "Compagnie des Chargeurs Réunis du Hâvre." The dimensions are:—Length between perpendiculars, 294 ft.; breadth moulded, 35 ft.; depth moulded, 25 ft.; tonnage nett registered, 1400 tons. She will carry about 3000 tons deadweight, and is classed at the highest class of Bureau Veritas, under special survey. She will be provided with direct-acting inverted compound engines of 1000 indicated horse-power by the same firm at La Seyne. She will be fitted with double bottom for water ballast, four steam winches, and all the most recent and improved appliances for expeditious loading and discharging cargoes, patent windlass and patent steam steering gear. In addition to superior cargo space for the conveyance of general goods, the vessel will be able to accommodate in tween-decks, 460 emigrants. She has been christened *La Ville de San-Nicolas* as she left the ways. She will form the second of a fleet of five screw-steamers ordered by the same firm at Havre—the first one, christened *La Ville de Rosario*, and launched July 16th, is nearly ready for her trial trip.

TRIAL TRIPS.

Westport.—Previous to sailing for New Zealand, this steamer went down the Clyde on a trial trip. She is a vessel of 500 tons burthen, 155 ft. long, 22 ft. beam, and 11 ft. depth of hold. She is 420-i.h.p., and she ran the lights at a mean speed of 11 knots per hour. The *Westport* was built to the order of Captain Williams, coal merchant, Wellington, New Zealand, by Messrs. Murdoch and Murray. She was engined by Messrs. Muir and Houston, Glasgow. The *Westport* is a sister ship to the *Romeo* (s.), which left Glasgow last year for Manila, and is fitted up for 20 first-class, 32 second, and a like number of steerage passengers. She is equipped with all the latest improvements both as to gearing and the securing of comforts to the passengers.

Tempo.—On August 27th the screw-steamer *Tempo*, of Newcastle, was taken to sea for official trial. The *Tempo* was built by Messrs. T. and W. Smith, North Shields, and launched from their yard in July. The vessel is owned by Messrs. Fenwick and Reay. Her dimensions are 230 ft. by 35 ft. by 17 ft., and her engine power will be 120-horse power nominal. She has water-ballast tanks, and her arrangements on deck combine all the latest improvements for rapid loading and quick discharging. To further this end her hatches have been specially arranged so that cargo can be taken from two ordinary spouts simultaneously. Messrs. Hawkes, Crawshay & Co. put her engines in at their Gateshead works. The *Tempo* also has Donkin's and Nicholls' patent steam steering gear, in addition to the hand wheel. She is destined chiefly for the Baltic and coasting trades, and left for Stockholm, after the trial, with a cargo of coals. The trial was a most satisfactory one. There was a rather heavy sea on, and the owners, who were on board, were enabled to test the sea-going qualities of their vessel, on the measured mile, against a strong head sea and tide. A mean speed of 10 knots per hour was obtained.

Pacha.—On August 31st the steamer *Pacha*, recently purchased by Mr. Robert Taylor, left the Dundee Harbour on a trial trip. The vessel was for several years employed in carrying goods and passengers between Hull and Hamburg, and has been acquired by Mr. Taylor as a general cargo boat, and has undergone extensive alterations. All the holds have been refitted, the engines and boilers have been carefully overhauled, and the ship has been re-classed at Lloyd's. Before returning to Dundee the speed was tested by the measured mile, and was found to be at the rate of 9½ knots per hour. Captain Easson has received the command of the ship.

Portugal.—On September 1st, the steamer *Portugal*, which has been built to the order of the Empreza Nacional, of Lisbon, by Earle's Shipbuilding and Engineering Company, was put upon her official trial. This vessel is intended to trade between Lisbon and the West Coast of Africa, carrying mails and passengers. A trial of speed by the patent log gave 12 knots per hour. The dimensions of the *Portugal* are—length 291 ft., breadth of beam 35 ft., depth of hold 25 ft. 6 in., gross carrying capacity 1,966 tons. The vessel is brig rigged, and will be able to carry a large spread of canvas. She is steered by steam gear, situated in deckhouse amidships, the gear in use being Bow and McLachlan's, of Paisley. There is also in the steering-house a hand wheel, which is always connected, and Skinner's patent hand steering gear which can be almost instantaneously connected. The passenger accommodation is as follows: Saloon, 60 passengers; second-class, 32; third-class, 120. The *Portugal* is partially a double-bottom and partially a tank ship, and she carries 400 tons of water ballast, whilst her bunkers hold 360 tons of coal. She is propelled by engines of 220-horse power nominal, and on the trial trip, with sixty-two revolutions they indicated 1,342-horse power.

Waverley.—On September 1st, this vessel, recently launched by Messrs. Gourlay Brothers & Company, Dundee, for Messrs. Williamson, Milligan & Company, Liverpool, went. on a trial trip. When she got to the Buoy of Tay she ran the distance from there to the Bell rock. From thence she proceeded in the direction of Anstruther. The run was continued to Elie, and there the homeward voyage was begun. On the way the *Waverley* again ran the distance between the Bell Rock and the Buoy. The average speed was 13¼ knots. The *Waverley*, which is a ship of 3,000 tons, is provided with Emerson, Walker and Company's Patent Direct Steam Capstan Windlass and every modern improvement. She sailed for London, and there loads for the Cape.

Rome (s.s.)—The magnificent steamer *Rome* is one of the latest additions to the fleet of the Peninsular and Oriental Steam Navigation Company. She has been built by Messrs. Caird & Co., Greenock, who have for a long time built steamers for the company. The *Rome* was launched on the 14th of May last from Messrs. Caird's yard. She is 430 ft. long, 44 ft. broad, and 36 ft. deep, with engines of 5,100-horse power indicated. The vessel has been specially built with a view to meet the rapidly developing trade between this country and Australia. She will be able to carry about 4,000 tons cargo. She is excellently fitted up all over, and the walls of the saloon and music room inlaid with carved walnut from Italy. There is accommodation for 160 first-class passengers, whose quarters are, contrary to the usual custom, situated amidships and forward. Fifty second-class passengers will be accommodated at the stern. The vessel is practically a four-decker, having hurricane deck, upper deck, main deck, and lower deck. She is divided into seven water-tight compartments, and is provided with an extra large number of powerful pumps. The crank-shaft, which is of Vickers steel, weighs 30 tons. All the most modern appliances for the rapid loading and discharging of cargoes have been fitted. On September 3rd the *Rome* took a preliminary trip down the Firth of Clyde as far as Brodick Bay. There was a distinguished party of ladies and gentlemen on board, including Mr. Sutherland, chairman and manager of the company. The engines worked in a satisfactory manner. The *Rome* will proceed to London shortly, and she will start on her maiden voyage for Australia early in October. On her official trial she attained a mean speed of 15 knots, which was considered highly satisfactory by all concerned, especially as she has not been docked since launched four months ago.

Ville de Naples.—This steamship, 1,900 tons, built and engined by J. & A. Inglais, Pointhouse, for the mail and passenger service of the Compagnie Generale Transatlantique, in the Mediterranean, went down on the Clyde on September 7th, for the purpose of adjusting compasses and running the usual trial trip before proceeding to her distination. The *Ville de Naples* has been furnished with every modern improvement, her interior being fitted up in a superior manner for the comfort of both passengers and crew.

Thetford.—The trial trip of this screw steamer, which was launched a few weeks ago from the yard of Mr. R. Thompson, Southwick, to the order of Messrs. Thompson and Wrightson, of the Standard Steamship Company (Limited), Sunderland, took place on the 8th inst., under favourable circumstances. In length the *Thetford* is 248 ft. between perpendiculars, in breadth 34 ft., and in depth 17 ft. Her decks are all of iron, with the exception of the small poop, which is of wood. All the best and latest improvements in the equipment of merchant steamers have been utilised, four large hatches being provided, in order that cargo may be loaded rapidly and economically, while the vessel is specially adapted for carrying grain in bulk. Each hatchway is supplied with a powerful steam crane by Messrs. Clarke, Chapman & Gurney, of Gateshead. The engines are on the compound surface-condensing principle, and were supplied by Messrs. G. Clark, Southwick. The cylinders are 31 in. and 57 in. respectively, with a 36-in. stroke, working up to 80 lbs. pressure, and indicating 750-horse power. All being in readiness, the steamer's head was turned northward, in order to have a trial of speed over the measured mile off the Northumberland coast. The engines were found to be working most satisfactorily, and averaged during the trial 9½ knots per hour against wind and tide, the vessel having on board 1,900 tons of cargo.

Malabar.—The Indian troopship *Malabar*, Captain Grant, made a two hours' trial of her machinery September 9th in the Solent after repairs, and preparatory to her departure for Bombay. The trial was conducted by Mr. Charles Icely, Chief Inspector of Machinery, belonging to the Steam Reserve, and Mr. Morcom, of the Dockyard Steam Department, and there was a great number of ladies and gentlemen on board. The pressure in the boilers averaged 45 lbs. to the square inch, which was considerably within their working power, and with 48 revolutions of the engines per minute the ship realized the highly satisfactory speed of 13·2 knots per hour, with her full quantity of coal in the bunkers. The mean vacuum was 27 in. Since the previous trooping season the *Malabar* has been fitted with steam steering gear, and with remarkably good results, as the following comparative *data* of tests made by Mr. Crocker during the trial will show:—The ship was circled to starboard and port with steam and with the usual hand gear, one man sufficing to steer the ship with the former, while 16 men were required to man the wheel. With the steam gear the angles of rudder were 34 deg. and 32 deg. for starboard and port helm respectively, while with the manual gear the angles were 31 deg. and 33 deg., three and-a-half turns of the wheel being required in both cases. The difference in time required to get the rudder over under the two systems was very marked, and had an important result in the comparative handiness of the ship in going round and in the respective diameters of the circles. With the steam gear the rudder was got over in 15 sec. and 14 sec., whereas it took 2 min. 15 sec. and 2 min. 5 sec. to accomplish the same angle by hand. Under the new system the complete circles to starboard and port were made in 6 min. 14 sec. and 6 min. 40 sec., the respective diameters being 674 and 702 yards. By hand the rudder was got over in 6 min. 35 sec. and 7 min. 4 sec.; and as in the latter case the ship felt the bite of the rudder more gradually, the diameters of the circles were found to be 814 and 843 yards. At the conclusion of the trial the *Malabar* was swung for the adjustment of her compasses, and afterwards returned into harbour.

Clyde.—On September 13th the Peninsular and Oriental Steam Navigation Company's steamer *Clyde*, built and engined by Messrs.

Denny Brothers, of Dumbarton, of 4,100 tons register, went her trial on the Clyde, and attained a mean speed of 15·9 knots (equal to 18¼ miles per hour), the horse-power indicated being 4,900. This vessel is fitted with all the recent improvements. The *Clyde* will be despatched from London to Calcutta on October 11th.

Charkieh.—The *Egyptian Gazette* of the 17th ult. says :—The trial trip of the (s.s.) *Charkieh*, which lately took place, was, thanks to Mr. Caillard and the other members of the Poste Khedivieh Administration, made the occasion of a most agreeable day's holiday for many Alexandrians. The *Charkieh* is a smart-looking steamer, built by the Thames Iron Works Company in 1865. She is 267 ft. in length with 36 ft. 8 in. beam, and measures 1160 tons register. Originally the property of the old Azizieh Company, she was purchased by the Egyptian Government for L.E. 23,289. In 1872 she was sent to England to receive new boilers and undergo a thorough overhaul. These operations occupied fifteen months, and cost no less than L.E. 39,302. On her return to Egypt, with the exception of a short interval during the Turco-Russian war, when the *Charkieh* was employed in the transport of troops, she ran regularly with the mails between Alexandria and Constantinople, until November, 1879, when her boilers having given out, she was withdrawn from the service and laid up in the port of Alexandria. Her present engines are by Messrs. James Jack & Co., of Liverpool—Allen, Anderson & Co., Alexandria—a firm which has constructed several of the engines of the steamers belonging to the Moss line. The new compound surface condensing engines of the *Charkieh*, are of 1500 indicated horse-power, with boilers tested to 140 lb. to the square inch, to work at a pressure of 70 lb. to the square inch. The price of the engines and boilers delivered in Alexandria was £10,500.

Cameo.—On September 21st the steamship *Cameo*, built and engined by Messrs. Alex Stephen and Sons, Linthouse, Glasgow, for Messrs. Tellefsen, Wills & Co., Cardiff, ran her trial trip. The *Cameo* is intended for the general carrying trade, for which she is designed and equipped. Her dimensions are 300 by 39 by 25.4, with a double bottom for water ballast, on the bracket principle throughout. She has a full poop, containing saloon, captain's room, and a number of state rooms; the officers and crew being accommodated in houses amidships and a topgallant forecastle. The midship steering gear can be worked by either steam-power or hand at will. The after steering gear, the windlass, and other appliances for working the ship, are all of the most complete and most approved description, while those for working cargo are very ample and efficient, including powerful steam winches, &c., and the water-tanks are supplemented by provision for distilling and condensing 600 gallons of fresh water per day. The engines are of Messrs. Stephen's usual type, on the compound surface-condensing principle, having cylinders 35 and 65 in. diameter by 42 in. stroke, with large boilers, constructed to work at 80 lbs. pressure. At the trial everything worked with the utmost smoothness, and to the entire satisfaction of all on board. On the measured mile the steamer averaged 11½ knots. The *Cameo* is to be registered in Cardiff, and is constructed to carry 3,600 tons dead weight, with a freeboard of 2½ in. to the ft. of depth of hold.

Lesseps.—On September 21st there proceeded to sea from the yard of Messrs. Raylton, Dixon & Co., her builders, an iron screw-steamer, named the *Lesseps*, built to the order of Herr Jacob Christensen, of Bergen. Her dimensions are :—270 ft. long by 34 ft. 9 in. breadth of beam, and 24 ft. 7 in. depth of hold, and her burthen is about 2,600 tons, on 22 ft. draught. She is built on the three-decked rule, having upper and main decks laid, the latter of iron. Water ballast in a large chamber in mainhold forward of the engine-room. In a full poop aft are placed commodious cabins for the captain, chief officer, and two or three spare berths. She is fitted with steam steering gear on bridge house on deck, steam winches, patent self-reefing topsails, and all the latest improvements for a vessel of her class. Her engines, of 150-horse power nominal, are by Messrs. Blair & Co., of Stockton, and gave every satisfaction on her trial trip round to the Tyne.

Thyra (s.s.).—On the 13th of September the new screw-steamer *Thyra*, built by the Flensburg Iron Shipbuilding Company, made her trial trip in the Bay. She is a very handsome boat, built on the "spar decked" principle. Dimensions: Length, between perpendicular, 212 ft.; breadth extreme, 29 ft. 8 in.; depth of hold, 22 ft.; gross tonage, 1,036, and will carry about 1,200 tons dead weight. Her cabins for the accommodation of captain, officers, and a few passengers are below the spar deck amidships on the fore side of the engine-room, the entrance to which is protected by an elegant companion-house, which adjoins the chart-house, and is built of teak. In the two wing-houses under the pilot-bridge are fitted store, scullery, lamp rooms, &c. The engineers are accommodated on the afterside of the engine-room, under the spar deck, with entrance direct to the engine-room platform. This vessel is so arranged that in her light draught she is about 12 in. by the stern, as are most of the "spar decked steamers" built by this firm. The vessel is fitted with steam windlass, and three winches of the latest improvement; her deck has a very neat look, all skylights, companions, also binnacles and rail, &c., being made of prime "East India Teakwood;" the cabin is kept in a very fine style, and is made in French polished hardwood (mahogany and maple.) The engines, which are also built by the Flensburg Shipbuilding Company, are of 100-horse power nominal on the compound surface condensing principle. A large party, consisting of shareholders and builders, proceeded with her on her trial trip, which was very satisfactory, an average speed of 10 knots per hour being obtained with a consumption of 8 tons of coal per 24 hours. The (s.s.) *Thyra*, which is the fifth vessel built by the above-named company for Messrs. Bruhn & Co., is destined for the trade on the China coast, where she will proceed directly after her trial trip.

Torpedo Boats.—On August 31st trial was made of a torpedo boat built by Messrs. Yarrow & Co., in the presence of the Austrian authorities to test the consumption of fuel when running at a comparatively slow speed, in order to ascertain the distance such a boat can run at sea without putting in for a fresh supply of fuel. The dimensions of the boat are 100 ft. in length by 12½ ft. beam. The trial was made of four hours' continuous steaming at a speed of 11 statute miles an hour, and the exact consumption was found to be 196 lb. of Welsh coal per hour, which is equivalent to 8 tons of coal per 1,000 miles, and as such a vessel can carry 10 tons, torpedo boats of this size and description will be capable of steaming a distance of 1,200 miles without a fresh supply of fuel.

ON September 18th a trial took place of one of two sea-going torpedo boats built for the Austro-Hungarian Government by Messrs. Yarrow & Co., of Poplar. The run was made over the measured mile at Long Reach, in the presence of Count Cassini, naval attaché, and the chief officials of the constructive and engineering departments at Pola. The vessel in question is of the same dimensions and type as the *Batoum*, built last year by the same firm for the Russian Government, but in many respects considerably superior. Her dimensions are 100 ft. in length by 12½ ft. beam. This class of boat, as built by Messrs. Yarrow & Co., has been proved to be thoroughly sea-going. The *Batoum* steamed from London to the Black Sea. Two similar boats were built for the Argentine Government, one of which steamed round to Fiume and the other is now crossing the Atlantic. Six Greek boats, also of the same dimensions, have safely arrived in Greece. The engines are of the compound surface condensing type, and indicate about 550-horse power. The boats are fitted with two rudders, one forward and one aft, which are actuated by steam, so that the manœuvring powers are exceptionally good. A great improvement has been made in these boats as regards the manner in which the torpedo tubes are enclosed within the framework of the hull, so as to avoid the evils attendant upon the arrangement previously adopted, in which case the forward end of the tubes were exposed without any protection whatever. The terms of the contract between the Austrian Government and Messrs. Yarrow & Co., were to obtain a speed on the measured mile of 20½ knots. On trial, however, 22·1 knots were made with the utmost possible ease, and it was clearly evident considerably more could have been obtained had Messrs. Yarrow so desired. A further official trial took place on the 31st ult. to test the consumption of fuel when running at a slow speed long distances. Messrs. Yarrow & Co., according to their contract, had undertaken that sufficient coal could be carried on board to ensure a run of 1,000 miles. It was found during a run of four hours' continuous steaming at a speed of 11 statute miles an hour, the exact consumption was 196 lb. of Welsh coal per hour. As, however, such a vessel can carry ten tons it is proved that torpedo boats of this size and description are capable of steaming a distance of over 1,200 miles without a fresh supply of fuel. It may, however, be mentioned that on some of the Greek boats built by the above named firm of the same size, fifteen tons of fuel were carried; therefore 1,200 miles may be considered as a very moderate estimate.

A NEW second-class torpedo boat, No. 70, which has been built and engined by Messrs. Thorneycroft, of Chiswick, having passed a satisfactory trial on the measured mile at Portsmouth, has been allotted to the *Inflexible*. With a pressure of 130 lb. of steam, the boat realized a speed of 16·7 knots per hour. This is considerably in excess of the contract speed, and a premium of £700 will be paid over to the builders in consequence. Hitherto, the great engineering difficulty which has been encountered in torpedo craft of this kind has been to prevent the priming of the boilers, and the leakage of the tubes at the boiler plates when pressed at full power. Indeed, while the water level was so close to the steam pipe as to cause the boiling water to find its way through the steam apertures, the priming exposed the plates in some instances to the intense heat of the furnace and caused them to buckle, whereby the heads of the tubes were dragged from their fastenings. In the new boat these defects have been remedied by removing the upper row of tubes, thus increasing the height of the steam space, the consequent loss of heating surface being made up by extending the barrels through the smoke box, and adding a foot to the length of the boiler. The tubes are now also made of brass instead of iron, and are fitted with steel ferrules. In the first-class boats the boilers are to be strengthened by screwing the tubes into the boiler plates, whereby the barrels will act as stays and prevent the buckling which now ensues from different rates of heat expansion. As the new torpedo boat was found to answer all expectations, the whole of those which have been sent to Portsmouth will be returned to the contractors to have the improvements introduced.

Carlton Tower.—The steamer, *Carlton Tower*, left the Tyne for Southampton, whence she will proceed on her charter from the Union Royal Mail Company to the Cape, with passengers and general goods, Owing to the confidence the owners have in the *Neptune* engines, the usual trial trip was dispensed with; and the builders, Messrs. Wigham, Richardson & Co., have been informed of her arrival at Southampton in 36 hours, which is an average speed of close on 11 knots, although being in very unfavourable trim, and having strong tides against her.

St. Jean.—This screw steamer, lately launched at Havre by Forges and Chantiers de la Méditeranée, and built to the order of Messrs. G. Le Roy & Co., proceeded to sea to make her trial trip on September 16th. The vessel's dimensions are 220 ft. by 29 ft. 6 in. by 16 ft. 9 in. Average speed of 11 knots was attained on the measured mile, instead of 9½ stipulated by contract, the engines indicating 460-horse power. A trial was made to ascertain the consumption of fuel, and the result showed a rate of 1·85 lbs. per indicated horse-power per hour. This result was very satisfactory, and the engines worked during the whole trip with perfect smoothness. The *St. Jean* left Havre and proceeded to Newcastle where she will take a cargo of coal.

Tower Hill.—This steamer, which is the second built or the twin screw steamship company of Liverpool, made her trial trip on the Firth of Clyde on Friday, September 16th. The *Tower Hill* is a steel vessel of 4,100 tons, is fitted with twin-screws, worked by independent sets of engines, and will carry 5,000 tons dead weight of cargo at a speed of about 13 knots. Her length is 420 ft.; breadth, 45 ft.; depth, 26½ ft. She has been constructed to suit both the eastern and western trade, being fitted with punkahs for the east and with heating apparatus for cold climates. The twin-screw, as has been shown in her sister ship, the *Notting Hill*, effects safety and economy. The consumption of fuel by the *Notting Hill* on her voyage to Calcutta is said to have been 1½ lb. per indicated horse-power, which is the most economical on record. The new vessel has ten of Turner's patent boilers, her crank shafts are made of Vickar's cast steel; she is fitted with steam steering gear by Harrison, of Manchester, and also with a powerful direct steam capstan windlass by Emerson, Walker, & Co., London. Besides having all the most modern improvements in shipbuilding the *Tower Hill* has passed the Admiralty Department for the transport of troops, having 11 watertight compartments, all of which extend to the deck and can be fitted as a cruiser in the event of war, the boilers and engines being protected by coal armour. On the 'tween decks she could carry 1,000 troops. As a trading vessel she can carry 1,000 head of cattle. There is accommodation for thirty cabin passengers, but that accommodation could be indefinitely extended. The *Tower Hill*, which is built on the same lines as her sister ship the *Notting Hill*, was built by Messrs. Dobie & Co., of Govan, who have also another vessel of the same description, the *Ludgate Hill*, on the stocks for the same Company. The engines, of which there are two sets, were supplied by Messrs. James Howden & Co., of Glasgow. They are inverted cylinder compound surface-condensing (tandem), the high pressure having a stroke of 32½ in. and the low pressure 48, and can be worked up to a steam pressure of 125 lb. The managing owners of the company are Mr. H. H. Nott, and Mr. W. Becket Hill, of Liverpool. The *Tower Hill* ran over the measured mile three times, and the mean speed obtained was about 14½ knots. It should be added that the propellers were not entirely under water. After the trial had been made the company sat down to luncheon which was purveyed by Mr. Forrester, Gordon-street, Glasgow, in the saloon. Mr. Young, of Dobie & Co., presided. In reply to the toast of "Success to the *Tower Hill*," Mr. Nott after referring to the advantages of the twin-screw, said the company had started at a rate of insurance lower than had yet been made in shipping. Mr. Hill also spoke of the advantages of such construction of vessels as in the *Tower Hill*, and pointed to the fact that the *Notting Hill* during her voyage to Calcutta, had behaved most admirably in all weather, and consumed 25 per cent. less fuel than the ordinary ocean-going steamers.

Erl King.—The steamship *Erl King*, belonging to Messrs. W. Ross & Co., of London, which has been fitted with a pair of compound high and low pressure direct-acting engines of 250 nominal horse-power, having cylinders 36 in. and 70 in. diameter respectively, with a stroke of 48 in., steam being supplied from two large double-ended boilers, carrying a working pressure of 85 lbs. per square inch, was, on Saturday, August 13th, satisfactorily tried under steam, everything working smoothly and without any heating. At 65 revolutions per minute the vessel made 12 knots per hour. The machinery, which is of the newest and most approved type, has been constructed, under the superintendence of Mr. John McDougal, consulting engineer for owners, by Messrs. David Rollo & Sons, Fulton Engine Works, Liverpool.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—Ed.]

Dear Sir,—Will any of your readers kindly explain the process of ascertaining the pitch of a four bladed screw propeller, when it is lying on the ground, so that the boss is perpendicular to the ground; also,

Why is it, when a steamer is in a heavy sea way and the engines racing, that, immediately before the propeller leaves the water, the engines almost come to a stand-still, without the steam being shut off.

I enclose my card, and remain your obedient servant,

"A Young Third."

S.S. "T—— H——" Plymouth,
September 9th.

THE COLLAPSING OF MARINE BOILER FURNACES.

The following report by Mr. William Parker, the chief engineer surveyor to Lloyd's Committee, is of much interest and deserves careful attention.

Newcastle 100 *A Steamship Insurance Association.*

Newcastle-on-Tyne, August 16th, 1881.

Dear Sir,—At our recent settlement, in dealing with the appended report made to Lloyd's Committee by their chief engineer surveyor, my directors considered it so important and interesting to steamship owners, that I was instructed to send a copy of same to our members. I am, dear sir, yours truly,

Edward S. Scorfield, Secretary.

B. Waymouth, Esq., Secretary.

Lloyd's Register of British and Foreign Shipping,
2, White Lion-court, Cornhill, E.C.,
January 3rd, 1880.

Sir,—In accordance with your instructions I attended at Hartlepool, on the 29th December, for the purpose of investigating the cause of the apparently mysterious collapsing of the furnaces of the boiler of the screw steamer *Roumania*, which had arrived at that port a few days previously.

This vessel, which was launched only a few months ago, is the property of Mr. W. Gray, of West Hartlepool, and has been employed chiefly in the Mediterranean and Black Sea trades. She is fitted with a double-ended boiler made by Messrs. Thomas Richardson & Sons, of Hartlepool, who are also the builders of the engines. The boiler is 11 ft. 4 in. in diameter, and 14 ft. long, with four furnaces, two at each end, of 39 in. outside diameter, and 4 ft. 9 in. in length, the thickness being $\frac{7}{16}$ in. The furnaces are made in two plates having lap joints about 9 in. below the top of the fire-bars, and were made perfectly cylindrical. The two combustion chambers are common to both the forward and after furnaces without any division between them. The relative proportions of grate surface, heating surface, steam space, &c., are such as to render it an excellent steaming boiler, and no fault whatever could be found with its design, which is in accordance with the requirements of the Society's rules to work at a pressure of 85 lb. per square inch, for which pressure all the parts are amply strong. It appears that during the vessel's last voyage from Cardiff to Odessa, the whole of the furnaces collapsed in succession, the first one came down after about five days' steaming when the pressure was about 83 lb. per square inch, and was repaired at Lisbon, and the vessel proceeded on her voyage. On returning from Odessa this same furnace and another one gave out fourteen days' steaming under a pressure of 75 lb., while the two remaining furnaces collapsed about five days afterwards when the steam pressure was only about 50 lb. per square inch. The engineer stated that after each collapse the water in the boiler was changed, and the boiler run up with salt water. It is to be regretted that samples of the water that was in the boiler when the collapse occurred, and of that which was in use when the vessel arrived were not preserved, as an analysis of the same would have cleared up an important point in the case.

A careful examination of the furnaces showed that the damage to one furnace varied from another, only in the amount of depression of the indented parts, and the appearance of the plates being similar, it was evident that the collapse was caused neither by shortness of water nor accumulation of salt or scale. And any suggestion of structural weakness having caused the accident was entirely out of the question, as a furnace of the dimensions of those in this instance should be capable of standing in its cold state an ultimate collapsing pressure of about 550 lb. per square inch without showing any signs of weakness. So long, therefore, as the temperature of the plate did not far exceed the temperature of the water inside the boiler, the furnaces should have remained perfectly cylindrical under the approved working pressure of 85 lb. per square inch. But it was observed that the furnaces, tubes, shell plates, and all the inside of the boiler were covered with a black gluey coating of what appeared to be the refuse of the oil used in the lubrication of the cylinders. From the statement of the engineer, it appeared that at least half a gallon of Crane's mineral oil mixed with olive oil had been used each day for this purpose, and that neither the scum cock nor the blow-off had been opened while steaming. With the view of ascertaining how the deposit would affect water boiling when placed in direct contact with the surface of a plate, I suggested that an experiment should be made at the works of Thomas Richardson & Sons. Two dishes were made from boiler plate of the same thickness as the furnace plating of the boiler of the vessel; the inside of one was coated with a portion of the deposit, whilst the other was left clean; half a pint of fresh water was placed in each, and they were placed on the same fire, and the blast applied. The water in the clean dish commenced to boil in 25 seconds, but the water in the dish with the coating did not begin to boil until one minute and 25 seconds had elapsed, by which time the contents of the first dish had entirely evaporated. This experiment was repeated with the bottom of one dish covered with sand instead of the deposit, but no appreciable difference was observed between the sand-covered and the clean dish as regards time taken in boiling. A subsequent experiment showed that when the density of the water in the pan became greater, the deposit which had been placed on the bottom gradually mixed with the water, and eventually rose to the surface. The results of these simple experiments would seem to indicate that the deposit found in this boiler is a great non-conductor of heat when placed in direct contact with the surface of iron plates, and might be sufficient to account for the plates becoming heated and softened to such an extent as to be unable to resist the external pressure, and so collapse ensue, either shortly after steam has been raised or when the vessel has been steaming for some days. In the latter case, it would appear that in a boiler having large quantities of the refuse, this latter, which when steam was lowered would fall to the bottom of the boiler, remains there undisturbed, until by frequent extra supplies from the sea, the density of the water in the boiler is increased, when the sediment gradually ascends and mixes with the water, imparting to it, especially in the narrow water spaces between the furnaces, a consistency so great as to be incapable of absorbing the heat, the ultimate collapse being then only a question of time.

In order to avoid such accidents in future I would recommend that:—

(*a*) More care be taken in cleaning the boiler.
(*b*) Much less oil than half a gallon daily be used for lubricating the cylinders of an engine of this power, and
(*c*) Nothing but pure mineral oil be used.

I would also suggest the desirability of occasionally scumming, which has for some time been greatly abandoned in high-pressure boilers.

I may further add that this is not the first case that has come under my notice of furnaces collapsing in a somewhat mysterious manner.

The particulars of each case as far as obtainable are being carefully noted as they occur, and it is to be hoped that we may eventually be enabled to arrive at a conclusion which will satisfactorily account for the varying circumstances under which collapses have occurred.

The principal difficulty is to secure perfectly accurate and reliable information of the surroundings of each case.

I am, Sir, your obedient servant,
WILLIAM PARKER,
Chief Engineer Surveyor.

ANTI-FOULING AND ANTI-CORROSIVE COMPOSITION.

To the Editor of THE MARINE ENGINEER.

SIR,—Our attention has been called to an article in your impression of the 1st September last, on the subject of Anti-corrosive and Anti-fouling Compositions for ships' bottoms.

For the information of your readers and those interested in this all-important subject, we would ask you to favour us by inserting in your next number the following particulars of Gay's Marine Paints.

These paints were brought into use many years ago; but due to the decease of the inventor they have been allowed to lie dormant, until we took up the sale of them; which was only done after thoroughly satisfying ourselves of the great merits of the compositions.

We are able to state with confidence that of the numerous steam and sailing ships, which have been coated with these paints, notwithstanding many of them have been lying in badly fouling water for months at the time, no single failure has been brought under our notice.

The business is now being extensively worked by us, and we trust, ere long, to see these paints take that prominent position amongst competitors, which their great value warrants them in doing.

We should add that the Anti-corrosive paint is of such a nature that the first coat at once allays anything like rust of the iron, and at the same time forms a solid foundation for the other coatings.

The Anti-fouling Composition is so compounded that with the action of the sea water an exfoliating surface is produced and maintained, to which nothing in the shape of animal or vegetable matter can possibly adhere, but falls off at the moment of contact.

The great test of the merits of an anti-fouling composition is when applied to the bottoms of *sailing vessels*, which are at times obliged to remain for a long period inactive in a fouling harbour; such tests we can point to with the greatest satisfaction, as resulting from the use of Gay's Marine Paints.

In verification of the value of these paints, we add the Testimonial of the commander of a ship, the bottom of which was coated with them. She made several voyages out and home and was not redocked for TWO YEARS, after that time she was docked for examination and found to be perfectly clean and the plates well preserved.

This gentleman writes,—"I should always use your paints, as I never found or saw any others that excelled them as Anti-corrosive or equalled them as Anti-fouling Compositions."

Yours truly,
BROWN STEVENSON & CO.

To the Editor of the MARINE ENGINEER.

SIR,—I have read with interest the remarks upon Anti-Corrosive and Anti-Fouling Compositions in your September number. For the last twenty years I have served in iron ships, and during that time I have had experience of a number of Patent Compositions. I entirely agree with you in saying that a really effective composition is one of the great scientific requirements of the day; but there is one fact bearing upon the question to which I do not consider sufficient importance is attached, and that is, the manner in which compositions are applied to ships in dry dock. It is a fact well known to commanders and officers of steamers, that the time devoted to dry-docking and painting a vessel is very much grudged by the managers of large steamship companies, and the operation is generally a very hurried, and consequently a very imperfect one. It is no uncommon occurrence for a mail steamer to go into dry dock to be scrubbed, and very imperfectly scraped as the water leaves her, and for the painters' gang to follow immediately after the scrapers, thus giving the iron no chance to dry, and preventing the composition subsequently applied, from having a fair chance. Of course there are exceptions to this, but I have experienced it to be the rule.

Again, in a matter of so much importance, too great economy is not always the best policy, the number of coats applied should be regulated by the length of time that the ship is destined to be away, and the nature of the seas she is to ply in; but these are considerations frequently left out of sight by shipowners, and when the vessel returns loud complaints are made against the composition used, whereas a little more liberality in its use would probably have obviated the cause of complaint.

Another great mistake, frequently made, is chipping an iron ship with chipping hammers. This is a practice (in my opinion) to be avoided, it breaks the skin of the iron, and causes it to present a rough surface, favourable to the adhesion of animal and vegetable substances. An iron ship once chipped never recovers its pristine smoothness. Even in using the scraper great care should be used, and the officers of steamers and iron sailing-ships should be instructed to keep a bright look out upon the men employed on the stages, and forbid any hammering or rough scraping at all.

With reference to the composition used, the first consideration is to get a priming which while anti-corrosive, should contain no ingredients inherently antagonistic to iron, and this should be allowed fairly to dry before application of a second coat; this precaution, however, is frequently neglected, the great object being to get the ship on to her loading berth as fast as possible. I do not think I overrate the importance of this subject, when I say that the duties of steam-ship officers are important in dry dock, and require as much vigilance and attention as their duties on the bridge at sea, and conscientious officers will by no means neglect them.

The name of Anti-fouling Compositions is legion, and the difference of opinion as to their respective merits is great. I have found tallow and sulphur mixed and applied hot very effective for a short time, but it soon scales and comes off in large patches leaving the bare iron, and for a long voyage is useless. I believe that the compositions containing copper in any form are absolutely injurious to the iron. Although useful as anti-foulers, probably the best composition yet brought out is the Ferro Mangnesie Composition known as Foulger's Composition; this I believe to be the coating of the future, but whatever composition is used none will be effective unless the care I have referred to be used by those whose duty it is to superintend the cleaning and painting of iron ships.

It is unfair to the manufacturers of anti-fouling compositions to throw the entire blame of their non-efficiency upon the compositions themselves, where the instructions for applying them have been altogether neglected. Only the other day in the course of a conversation I had with one of Lloyd's surveyors the following circumstance was related to me. A large Liverpool steamer had just come into dock off a long voyage with her bottom as foul as a half-tide rock, she was coated with a well known composition, but it transpired that the anti-fouling composition had been used as a priming, and the priming put on over it; the fault was clearly the painters in the first place, and of the officers in charge in the second, always presuming that the casks were properly marked.

As a matter of fact we are only now beginning to learn the merits or rather the demerits of compositions. Iron shipbuilding is only in its youth, and sufficient time has not elapsed to enable a correct opinion to be formed of the effects of various ingredients upon the iron itself; the only safe plan is to adopt those compositions which are formed of ingredients which have an ascertained affinity for iron, and avoid those which have a deteriorating effect. There should be no reason why the life of an iron ship should not be with proper care, fully equal to, if not greater than the period assigned by the Psalmist to man.

Apologizing for troubling you at this length, and enclosing my card.—I beg to subscribe myself,

Yours truly,
A MAIL BOAT OFFICER.

To the Editor of THE MARINE ENGINEER.

SIR,—I was glad to read in your last number that your columns were open for the ventilations of the subject of Anti-corrosive and Anti-fouling Compositions for iron ships.

It has been my duty for the past ten or twelve years to investigate into the merits and demerits of the numerous compositions for preventing corrosion and fouling, as they have been brought out from time to time, and to report thereon. I shall be glad if you will give publicity to the result of my experience for the benefit of those who may be interested in this important subject.

In many instances the cause of failure of a composition has been due to the ship and dock owners rather than to the manufacturer. Ships are docked, the bottoms are washed down and scraped as the water leaves them, and the priming coat is immediately applied before the surface of the iron has had a chance to dry: the result being that the moisture on the surface of the iron is hermetically sealed with a waterproof coating formed by the application of the first or priming coat. Rust is consequently produced, and after a time scale is formed which drops off leaving the iron quite bare; corrosion now goes on at a rapid rate, and by the time the ship is redocked her bottom looks like a honey-comb.

Another cause of failure has been where the composition used contained copper in some form, and galvanic action has been set up, and after a time the iron became honey-combed, and corrosion went on increasing, eating its way into the iron, so that in a comparatively short period the plates became so deteriorated that they had to be replaced with new ones.

In other cases the composition used has decomposed in a short time by the action of the sea water, and the iron has been left bare. A composition made of zinc and tallow is now extensively used on sailing ships, but it soon decomposes and is only suitable for short voyages, and consequently it is highly recommended by dry dock owners.

My experience has taught me that no greater difficulty need be encountered in the preservation of iron ships from rust or fouling, than there was in the days of wooden ships, always provided due care is taken by the owners to allow sufficient time in dock for the work to be done well and to dry properly.

The surface of the iron, when in a foul state, should be scrubbed and scraped and allowed to dry; a priming coating of a good anti-corrosive paint or composition should then be applied, and this composition should be so compounded that it does not flake off, nor is in itself injurious to the iron, it should enter well into the pores of the iron to allay the progress of rust already formed.

Still another coat of such a composition should be applied on the top of this when dry, and finally the anti-fouling coating should be applied.

Upon the nature of this anti-fouling composition, really depends the success or non-success of the operation.

I have been at times obliged to listen to the most foolish remarks by the manufacturers of various compositions. Such as, for instance, "The compositions we make dry as hard and smooth as glass, nothing can stick to them." The fact is, that limpets and barnacles select hard and smooth surfaces to stick to, and vegetable matter also.

A good anti-fouling coating should be so compounded that it exfoliates from the surface immediately adhesion of any substance is attempted, but does not come off by the action of the vessel passing through the water. It should also be durable and without any ingredient that is injurious to the iron.

Some years ago I tested a composition which was in one instance applied to the bottom of a sailing ship, the *Winifred*, and she was properly done; she was abroad for TWO YEARS, lying for months together in badly fouling harbours. Nevertheless, on her return, upon examination of her bottom, she was found to be entirely free from fouling or rust.

The anti-fouling composition used in this instance was of an exfoliating nature, such as described above, and I am convinced that no surface, whether it be poisonous or otherwise, unless exfoliating, will prevent the adhesion of barnacles and weed.

If shipowners looked more after their own interests, and left less in the power of dock proprietors and their officials, there should be no difficulty in preserving the bottoms of their iron ships. A good and durable composition does not suit their purpose like one that would require to be re-done every voyage, and consequently a zinc and tallow composition is their friend, and they strongly recommend it.

Yours faithfully,
Ex Naval Officer.

To the Editor of the Marine Engineer.

Dear Sir,—We have read with pleasure your article on Anti-corrosive and Anti-fouling Compositions for ships' bottoms, in the current number of the Marine Engineer.

For some time past we have been engaged in bringing to the notice of shipowners our anti-fouling composition for ships generally, wood and iron, but finding great prejudice existing amongst ship-owners, and an unwillingness to grant those opportunities of a trial, which we sought, we determined to submit the composition to the Admiralty.

In due course we received a letter from the Secretary of the Admiralty inviting us to make trials on an iron vessel lying in Portsmouth Harbour. These trials were continued over a period of three years, at the end of which, the composition having stood the test, we received an order to coat the vessel entirely and for which we were paid.

The last trial was made in October, 1878, and on the vessel being docked for examination of bottom in April, 1880; (eighteen months after), the iron was found to be thoroughly preserved, the bottom free from vegetation, and the composition intact.

We will not dilate upon the merits of this composition, the trial speaks for itself.

We are, dear sir,
Yours truly,
Noldwritt & Murray.

6, Water-lane, Tower-street,
London.
September 20th, 1881.

LOSS OF LIFE AT SEA.

To the Editor of the Marine Engineer.

Sir,—The calamities that so frequently occur from shipwreck and other disasters at sea, involving such fearful sacrifices of human life as that from the wreck of the s.s. *Teuton* at the Cape, and the s.s. *Tararna* at New Zealand, and many other instances of a similar character, should cause the subject of "Loss of Life at Sea," and the means of averting such calamities, to be seriously considered by those who undertake the carrying of living freights from one part of the world to another, as also by the Government and its officials.

For ages past there has been a continuous sacrifice of human life from disasters at sea which might have been prevented by the adoption of means of a most simple and effective kind.

Vast sums of money, much skill and ingenuity are devoted to the means of destroying life, but very little consideration is given to the means of saving life, especially from disasters at sea.

In consequence of the fearful loss of life from the wreck of the s.s. *Atlantic* and the running down of the *Northfleet*, when nearly a thousand lives were sacrificed about eight years since, I was induced, while in Australia to give my attention as to whether some effective means could not be adopted to prevent such calamities in the future, which resulted in my invention and introduction of several articles for general use on ships which can be readily used for that purpose.

I was fully satisfied that it would not be advisable to design a lot of useless cumbersome articles to be carried about a ship for the purpose of meeting a contingency that may not happen, while it was possible to make the several articles of ship furniture such as mattresses, couches, seats, pillows, &c., of such a bouyant and convenient character as would not only answer the ordinary purposes required of them, but in time of danger are available for immediate and effective use as a means of saving life. I therefore determined, and have demonstrated conclusively, that the beds must be made the chief article of use for that purpose, and if vessels be fitted up according to the plan I propose there need be very little, if any, loss of life under ordinary cases of shipwreck. It is the simplest, most economical and only effective means that can be adopted to save the lives of passengers in time of sudden disaster.

As every man, woman, or child going to sea have to be provided with a bed, in the name of common sense and the instincts of humanity, why should they not be provided with a bed that would be of some service in time of danger, instead of the useless articles now generally used.

It was not only necessary that the beds, couches, seats, &c., should be made of such thoroughly buoyant material as will safely float its occupant in water, but it was also necessary that they should be so constructed as to be readily tied together for the formation of rafts or lashing outside of boats; and for that purpose have I specially designed them, so that it matters not whether there be ten, or fifty, or five hundred persons on board ship, if each is provided with a life preserving mattress, as I suggest, then there is not only enough bouyant material ready at hand to float all hands with safety, but the shipowners will be free of blame or moral responsibility for not having made provision to meet such cases of maritime disasters as so often occur, and with such fearful results.

I unhesitatingly assert that there is no necessity for this continuous sacrifice of human life by drowning from shipwreck, and the wholesale destruction of humanity that has been going on unchecked for years is a disgrace to our intelligence and civilization.

The best vessels afloat and the most skilful officers are liable to accidents, and it is when the largest vessels are wrecked that the great loss of life takes place. It is, therefore, incumbent on the owners of vessels to provide such appliances as practical experience has proved to be most effective.

When a public disaster, like that of the *Princess Alice* or the *Teuton* takes place there is usually displayed a large amount of practical sympathy to relieve the widows and orphans of the unfortunate sufferers, but how much better would it be if a little more practical philanthrophy was displayed to prevent such disasters from occurring, by having the vessels properly fitted with life-saving appliances.

I am in a somewhat invidious position in reference to advocating the cause of saving life from shipwreck, simply because it would appear to be advocating my own personal advantage; but I am, however, at a loss to conceive why the subject should be refused discussion in the public press on that account, and trust that your sense of justice to the cause of humanity, and the special advantages of safety that would accrue to seamen and passengers by having this question discussed and acted on, will ensure this letter a place in your valuable paper.

The question resolves itself into one of common sense, intelligence, and humanity, as against prejudice, ignorance, and foolhardiness. Nature has abundantly supplied mankind with material possessing such bouyant and healthy properties, that if utilized for bedding and other ship furniture, can be made the means of materially reducing the loss of life and averting the dangers of the sea, without materially enhancing the cost of fitting up of ships. It is surprising that so many should ignore the teachings of natural laws and the principles of humanity and self-preservation, by refusing to adopt such articles for saving life as practical experience have proved to be most effective.

I am, Sir, yours, &c.,
Thomas Cornish.
Inventor of Life Saving appliances.

109, Fenchurch Street,
London E.C.

The City of Dublin Steam Packet Company's vessels are being fitted up with the necessary apparatus for lighting on the Pintsch system.

Gravesend is, after the 4th inst., to be the port of embarkation for the Peninsular and Oriental Company's steamships, instead of Southampton. The new steamer *Rome* leaves on that day. Arrangements have been made with the London, Tilbury, and Southend Railway for the despatch of a special train from the Liverpool Street station of the Great Eastern Railway, at 11 a.m. every Tuesday, to Tilbury, whence passengers will be conveyed to the company's vessels in a commodious river steamer.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 23rd August to September 24th, 1881.

3661 W. M. Brown (communicated by G. H. Richards). Valve stem supports.
3665 J. W. de N. Galwey. Steam boilers.
3666 W. D. & S. Priestman. Steam pipes and connections for dredger cranes, &c.
3676 J. Smith and S. A. Johnson. Valves.
3687 C. de Lucia. Slide valves.
3694 J. Musgrave and A. Walsh. Starting safety gear.
3706 J. Lynn. Steering apparatus.
3721 T. Edmond. Rope and hawser stoppers.
3724 A. M. W. Samson. Construction of ship to reduce rolling and render unsinkable.
3729 Lord Elcho. Range finder.
3734 R. Balderston (communicated by A. Bonamy). Manufacture of fishing nets.
3742 E. Fromentin. Feeding steam boilers.
3751 A. B. Rodyk (communicated by N. B. Dennys). Ships' bottom, &c., anti-fouling composition.
3759 W. R. Lake (communicated by A. M. Crosby). Levelling berths.
3767 J. H. Fox. Steam engine for pumping propelling vessels, &c.
3775 T. C. Dunn (communicated by W. Miller). Self-levelling berths.
3790 W. R. Lake (communicated by S. D. Strohm). Telegraphic cable insulation, &c.
3800 J. R. Oldham. Steam boilers.
3848 J. Blake. Steam generators.
3851 S. Pettit. Detaching ships' boats.
3855 W. J. L. Hollis. Lubricants.
3875 A. B. Brown. Starting engines.
3878 C. Bedford. Steam engines.
3889 T. Davies. Safety valves.
3891 T. Archer, jun. Steam winches.
3920 R. Hodson. Rotary engines.
3939 A. Shaw. Worm gearing.
3941 F. H. F. Engel (communicated by G. W. Claussen). Propelling and steering screw steamers.
3949 W. Currie. Lubrication.
3952 J. Wetter (communicated by G. B. Berrell). Life boats.
3953 J. Wetter (communicated by C. Arentsen). Capstans.
3954 A. Thomson. Broken shaft coupling.
3967 J. G. Ellis. Lamps and burners for ships, &c.
3969 H. Muir and J. Caldwell. Steam steering engines.
3983 F. H. F. Engel (communicated by C. A. Zirn). Pistons for steam engines.
3990 A. M. Clark (communicated by P. Oriolle). Automatic fire extinguishing apparatus.
3997 H. Cheesman. Controlling wire rope.
4009 R. M. Steele. Screw propellers and construction of vessels.
4012 F. H. Ward and E. Howl. Pulley blocks.
4020 G. West. Smoke consuming.
4022 A. F. Yarrow. Torpedo boats and other vessels.

⁂ Any information regarding these or other patents will be gladly furnished on application.

The most flourishing branches connected with iron and steel are, according to Messrs. Bolling & Lowe's *Iron Trade Report* the shipbuilders and heavy engineering trades connected therewith. According to the most recent register at Lloyd's, it appears that the number of steamers built in 1879 was, iron, 270 tonnage, 463,414 tons; steel, 23, tonnage, 21,222 tons; total, 484,666 tons. In 1880, iron ships, 401, tonnage, 487,404 tons; steel ships, 30, tonnage, 38,164 tons; total, 525.568 tons. In progress of building 1st July, 1881, there were of iron, 550 ships of 900,000 tons; and of steel, 50 ships of 120,000 tons; giving a total of 1,020,000 tons an enormous increase upon last year's operations, nearly doubling the figures in about six months. The nnmber of steel boilers built was 1878-79, 220; 1879-80, 380; 1880 81, 500; and at the present moment there are 528 pairs of marine engines and boilers building of effective horse-power 500,000.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

August 27th, 1881.

Brown, William	1 C	London.
Bruce, Alex. ...	2 C	do.
Gray, Charles ...	2 C	Lvrpool.
Grieve, Thomas...	2 C	N Shlds.
Harrold, Jno. Wm.	2 C	do.
Kelly, Anthony W.	1 C	do.
McCallum, Malcolm	2 C	Lvrpool.
Meek, Leslie ...	2 C	London.
M'Gregor, John	2 C	Lvrpool.
Power, Edward M.	1 C	London.
Roberts, James...	1 C	Lvrpool.
Rontree, Thomas	1 C	do.
Ruse, A. ...	2 C	London.
Smith, David ...	1 C	N Shlds.
Thompson, John	2 C	do.
Vickers, John ...	1 C	do.
Willcock, Henry	2 C	Lvrpool.

September 3rd, 1881.

Allan, Robert ...	1 C	Glasgw.
Bannatyne, Archbd.	2 C	do.
Baxter, Thomas A.	1 C	London.
Boyd, Andrew ...	1 C	Bristol.
Campbell, Robert	2 C	Glasgw.
Chisholm, Wm. F. K.	2 C	do.
Crute, John ...	2 C	Sndrlnd.
Dixon, George ...	2 C	do.
Edwards, Wm. A.	2 C	Bristol.
Forrest, James M.	1 C	Glasgw.
Gellanders, Alex.	1 C	do.
Greenaway, Charles	1 C	London.
Gilder, Edward G.	1 C	Glasgw.
Halliday, John ...	1 C	Sndrlnd.
Halvarsen, Hans	2 C	N Shlds.
Harvey, Wm. ...	2 C	do.
Keith, Dugald ...	2 C	Glasgw.
Kerr, William ...	2 C	London.
Laird, James B. ...	1 C	N Shlds.
Lancaster, Chas. F.	2 C	Lvrpool.
Magee, Patrick ...	2 C	Sndrlnd.
Mayo, John ...	2 C	Bristol.
McCulloch, Hope	2 C	Lvrpool.
McFarlane, Joseph	1 C	Glasgw.
Morrison, William	2 C	do.
Mutrie, David ...	1 C	do.
Rae, Alexander...	1 C	do.
Richardson, Hedley Thomas	2 C	Bristol.
Roy, Robert P. ...	1 C	Glasgw.
Soutar, Robert ...	2 C	London.
Stockwell, A. C.	2 C	do.
Talbot, Arthur E.	2 C	Lvrpool.
Taylor, William	1 C	N Shlds.
Turnbull, Matthew	1 C	Glasgw.
Whitworth, Edwin J.	1 C	Bristol.

September 10th, 1881.

Ash, Thomas ...	2 C	London.
Ball, Arthur ...	2 C	do.
Brewer, Harrold	2 C	Hull.
Cooper, Jas. Wm.	2 C	N Shlds.
English, William	2 C	do.
Fraser, Robert ...	1 C	Lvrpool.
Fulton, Jno. Wm.	1 C	do.
Holding, Henry...	2 C	do.
Martindale, Hny. T.	2 C	N Shlds.
Menzies, Jas. ...	1 C	London.
Orr, Samuel ...	2 C	do.
Pegden, John B.	2 C	Hull.
Swan, Arthur, G.	1 C	N Shlds.
Stephenson, Silvester ...	1 C	Lvrpool.
Street, Albert ...	2 C	London.
Tone, Wm. R. ...	2 C	N Shlds.
Treharne, W. D.	2 C	do.

September 17th, 1881.

Campbell, Duncan	2 C	Lvrpool.
Chapman, Henry	1 C	do.
Davison, Ralph...	2 C	N Shlds.
Dunn, David ...	1 C	London.
Evans, David L.	2 C	Lvrpool.
Gibbon, William	2 C	Cardiff.
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NOTICE.

In consequence of the pressure on our space this month, we are compelled to let the article on "Screw Propellor Experiments," stand over until our next issue. —[Ed. M.E.]

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, NOVEMBER 1, 1881.

EDITORIAL NOTES.

THERE has been much dissension amongst naval architects and other experts as to the question of how far steel ships pay for their extra cost of construction over iron ships. We have ourselves defined that this point will depend largely upon the average class of freights which they are in the habit of carrying. As a valuable datum to this controversy, we are glad to be able to refer to the results from a dead-weight carrying steamer engaged in the Bilbas ore trade. It was built of steel in 1877, at a cost of £18,350, that is an increase of £1,350 above what her cost would have been if she had been built of iron. By the lightness of the hull, obtained by the reduced scantlings of the steel, she has been enabled to earn £840 gross per annum in addition to what she could have earned from her carrying capacity had she been of iron. If from these gross extra earnings are deducted the cost of discharging the extra cargo and the extra insurance, &c., there is still left a yearly gain of £560 for the additional outlay of £1,350. This is not a bad return, amounting as it does to over 40 per cent. Our former remarks must, however, be borne in mind that this result, which may apply to every dead-weight carrying cargo vessel, will not apply to bulk cargo carrying vessels, such as cotton or grain, nor even to general cargo vessels, as the additional lightness of the hull gained by the use of steel would not in such cases add anything to its freight-carrying capacity.

THE Government have just discovered a mine of unrealised wealth. Engine work, as we all know, is mighty expensive, and as an engine cannot vanish into thin air, and, if well treated, is very little the worse for wear as year by year goes on, the engines of steamers thrown out of commission ought to be as serviceable as ever, barring any old fashion that there may be about them. As, however, cylinders are always cylinders, and pistons, cranks, and air-pumps have not varied much in construction during the lifetime of the last generation of ships, the engines therefrom should have at least a certain value and usefulness for further application. It has, however, never been the habit of the English Government to realize the value of such engines when the steamers have been paid off. This has been a great error, as the deterioration of engines or boilers is much greater when lying still out of use, than when in constant work. We may enumerate amongst ships which are entirely laid off, the *Victoria*, the *Howe*, the *Royal Albert*, the *Defiance*, the *Anson*, the *St. George*, the *Royal William*, the *Albion*, and the *Rodney*. The original cost of putting engines into these vessels amounted to £368,000. There are also engines worth originally as much more in steamers pronounced "incurable," in the sense of being unfitted for taking a place in our present iron-clad Navy. Surely these engines, amounting in their gross original value of over £700,000, are worth realizing, and if all such hulks, with all fittings, were promptly realized as they become out of date, the proceeds would go far to help the Naval Exchequer for the expensive experiments which are now so necessary.

THE voyage of the *Inflexible* is being watched with considerable interest. Some little disappointment has been felt that her speed on the measured mile was not better. In her run from Portland to Plymouth she has, however, done better, inasmuch, as she has made 12 knots the entire way, and only with 50 lbs. of steam instead of 60 lbs. in her boilers. As is frequently the case with new machinery, it warms to its work after some little time has elapsed. In the matter of steering also the vessel has much improved from greater experience in handling her. It is, however, the general opinion that her rudder is scarcely large enough, which probably will be remedied at Malta. The weather on leaving Portland was rather heavy, and the behaviour of the vessel was considered very satisfactory. The lower booms were forced adrift but were got on board and secured on the top of the poop. A further novelty under trial in the *Inflexible* is the water balance chamber. This chamber carries 70 tons of water, which is applied for the purpose of checking the roll of the vessel. This was suggested by the late Mr. Froude and promises to be very effective for the purpose.

WE have before us a circular from a north country sea-going Engineers' Association which is deserving of every attention and support. The value to individual members of any trade or profession by banding themselves together is now well recognized, not only does it give an efficient means for resisting an undue pressure for the reduction of wages, but as a means for insurance against death, injury, or legal proceedings, its value may be sensibly felt in the ordinary routine of work. The association in question, dating its head-quarters from Sunderland, already numbers 700 members, and eight branches of it very sensibly seeks to affiliate all sea-going engineers or other already formed Societies in connection to itself. This Association is in direct communication with an Australian Society of sea-going Engineers, numbering over 400 members. By means of these intercommunications the rate of wages in Australia is always known to the English Association, and the engineers making contracts in England for service at the colonies can be advised, if a member of the Association, what is the regular rate of wages obtainable on the station. Loss of clothes by shipwreck is also made up to the members of the Association by a payment of £5. This amount, though small in itself, is very welcome after such a loss, and a special payment is made to the widow in the case of the death of a member.

THERE is still hope of rendering a great deal of the comparatively light artillery serviceable against modern armour-plated vessels. The 9 in. gun has hitherto been regarded as obsolete and useless against armour, as the energy of the projectile, 3,500 foot-tons, is a mere trifle compared with the 27,300 foot-tons developed by the 16 in. or 80-ton gun. It has however, been discovered that the penetrating power of a projectile depends as much on the material and the shape of the penetrating face, as on its energy of motion. A shell of a special quality of wrought iron has been manufactured at Woolwich, which combines in a wonderful degree the qualities of hardness and toughness. A greater length of projectile with a much more angle of point than has hitherto been used, have been now experimented on, with most striking and startling results. The target representing an armoured vessel was penetrated, backing and all, and the results may be considered as doubling the effective power of modern artillery.

EXTENSIVE MASONRY WORKS AT THE DUBLIN CUSTOM HOUSE DOCKS.

(FROM A DUBLIN CORRESPONDENT.)

A PARTY of members of the Social Science Congress here have visited the Custom House docks and vaults. They proceeded to the north wall extension for the purpose of seeing a great block of concrete, 350 tons, forming part of the series of which a boundary wall of the extension is composed, put into its place. These works were commenced ten years ago. Over a thousand feet of the extension is complete, forming a roadway of 250 ft. wide. On the south side of this is the river. On the north side a tidal basin, already in use for shipping, which will be 2,500 ft. long when finished. The boundary walls of the quay on each side are formed of blocks of the size now deposited. The first of them was set on the 27th of May, 1871. The one now placed was the 326th block. Each is thirty-one feet high, and of proportionate dimensions otherwise. They have been all made at one side of the basin, the component parts being irregular masses of Dalkey granite, Portland cement, and gravel dredged from the river. The ,cement and gravel are mixed by steam machinery. The materials are put into a mould, framed of boards, where they remain until consolidated. These blocks are lifted from one side of the basin to the other by a large iron vessel, 1,600 tons burden, called a "Shears" float, which is furnished with steam engines, enormous iron arms in derricks, extending to a great height at one end, and iron chains and pulleys of massive size and peculiar construction. The hull and arms of the vessel were made in the yard of Harland & Wolff, Belfast. The steam engines are by Grendon, of Drogheda, and the deck machinery of cog wheels, to which the chains are attached and by which the requisite power is gained, is by Messrs. Courtney & Stephens. In the first part of the operation—the lifting of the block from where it was made—the pulleys from the arms of the shears are attached to four iron bars passing through the block, and the ends of which project through the upper part of it. The process of lifting is always begun when the tide is rising, and it takes place when the barge is "hove short" —to use a nautical expression—upon the block, like a ship upon her anchor, through the combined power of the rising tide and the machinery. In case of necessity, however, the machinery alone would do the work. The depression at the end of the vessel from which the shears extend, caused by the weight of the block, is balanced by pumping water into a compartment at the other end, so that she can be brought to an even keel. The shear's float, with this ponderous block suspended from her arms, was warped across the basin to a position next the wall which is being built, where she lay when the visitors arrived. It was then low water, and the moment the men got on board, the "breaks" on the machinery were relaxed, and the block slowly descended into the water, which was then about twenty-eight feet deep. The site at the bottom had been previously prepared by men who worked from a diving-bell. By movements of the vessel and her chains, and by wedges, the block was adjusted in its place with precision.

HER MAJESTY'S SHIP "INFLEXIBLE."

THE double turret ship *Inflexible*, Captain J. Fisher, steamed from her moorings on the morning of October 17th, shortly after 7 o'clock, for the trial of her engines on the measured mile in Stokes Bay; and as this was the first occasion of her leaving Portsmouth harbour since she was commissioned, she saluted the flag of Admiral Ryder, the Commander-in-Chief, on arriving at Spithead. The trial was conducted by Mr. Charles Iceley, on behalf of the Steam Reserve, and was watched by Mr. E. Newman, on behalf of the Dockyard Steam Department, while the practical management of the machinery was superintended by Mr. J. H. Heffernan, the chief engineer. The importance and novelty of the trial attracted a large number of interested witnesses of the behaviour of the engines and ship, among whom may be mentioned Captain Colomb captain of the Portsmouth Steam Reserve; Mr. James Wright, C.B., Engineer-in-Chief; and Mr. W. H. White, Chief Constructor at the Admiralty; Professor Sir William Thomson; Mr. R. Barnaby, Constructor at Portsmouth; Admiral Raby, V.C.; and Captains Hallowes and Beaumont. Admiral Ryder witnessed the steaming from his yacht, and at the conclusion of the trial he went on board and inspected the ship.

The propelling engines, were manufactured by Messrs. Elder & Co., of Glasgow, each of the twin screws is worked by independent compound engines of the inverted or hammer type, having each a high-pressure and two low-pressure cylinders. The high-pressure cylinders are 70 in. and the low-pressure cylinders 90 in. in diameter, the stroke being 4 ft. The steam from the low-pressure cylinders is exhausted into separate condensers, having a total cooling surface of 16,000 square feet; and in being condensed, it passes through an aggregation of tubes of ¾ in. external diameter, of which each condenser has no fewer than 6,650. The expansion is effected by link motions on the main slides. At starting, the engines are assisted by auxiliary steam gear, the valves of which are fitted to the receiver. Steam is furnished by 12 boilers, eight single ended and four double-ended, the latter being placed along each side of the middle line bulk-head.

Since the ship was commissioned, much has been done by Captain Fisher to improve not only her efficiency as a fighting engine, but her appearance; and as she proceeded to Spithead a great deal might be said, notwithstanding the general impression as to turret ships, in her favour from a purely pictorial point of view. The turrets and superstructures, which are painted black, are surmounted by a somewhat rakish white riband, while a yellow weather cloth, which runs in a line along the weather deck and the tops of the turrets, conceals the open spaces under the bridge, and gives the monster the appearance of a broadside ship. The weather was particularly fortunate for the steam trial. The sea was perfectly calm, a light breeze blowing with a force of four from the south-east, and consequently upon the starboad bow and port quarter, while the ship was making her runs upon the mile. Owing to there being considerable difficulty in getting up a satisfactory pressure of steam in the boilers, the preliminary cantering in the Solent for the purpose of coaxing the fires lasted until 10 o'clock, when the first run was made on the mile. It will, however, be seen that, although the blast was kept on throughout the trial, the average pressure of steam was not equal to the actual load of 60lb. on the safety-valves. There was, therefore, no waste, the engines utilizing all that could be passed through the cylinders, notwithstanding the fact that the propellers, which, on the light trim six hours' trial, had a mean pitch of 20 ft. 6 in., had had the pitch coarsened to 21 ft. 6 in. The following are the results of the four full-power runs:—

	Revolutions.		Speed.
	Starboard.	Port.	Knots.
First mile ...	71·96	70·30	12·371
Second mile	71·65	71·00	12·950
Third mile	72·55	71·49	12·766
Fourth mile	72·46	71·40	12·676
True mean speed			12·774

It was originally intended that two runs should be made upon the mile at two-thirds power, and two runs at one-third power. In consequence, however, of the delay which took place at the beginning of the day's work, the tide proved unsuitable. Dangerous shallows began to show themselves, and it was only by the pilot, Mr. Harding, making a *détour* to Cowes and rounding the middle buoy, that the last two full-power runs could be completed. The following are the mean results of the steaming:—

	Starboard Engine.	Port Engine.
Steam in Boilers, 58·25lb.		
Vacuum, Forward	27·12	27·31 inches.
„ Aft	27·37	26·37 „
Revolutions per minute	72·15	71·04
Mean Pressures, High ...	29·1	29·87lb.
„ Low	9·56	8·97lb.
Indicated Horse-power, High...	1,959	1,980
„ „ Low ...	2,128	1,967
Total Indicated Horse-power ...	4,087	3,947
Collective Horse-power	8034	
Speed of Vessel...	12·774 knots.	

So far as the performances of the engines were concerned these results where highly satisfactory. There was no priming, the vacuum was good, and there were no hot bearings. The collective horse power developed by the engines was also 30 horses beyond the contract, and 136·68 more than were obtained at the six-miles run with the same propellers, though 373 horses fewer than were obtained during a similar protracted run with the two-bladed propellers. In comparison, however, with the trial in December last the mean speed realized was somewhat of a disappointment to many on board. Had the trial fulfilled the ordinary stringent conditions of a measured mile trial, the difference in speed between 12·774 and 14.286 knots per hour would have been inexplicable. The trial however, was less for comparison of results than for the satisfaction of Captain Fisher before proceeding on his experimental cruise, and for the information of the Constructive Department of the Admiralty, though with regard to the latter purpose it is probable that, owing to an eccentricity in the steering, the *data* will be considered of small value. Although the *Inflexible* did not receive her powder and shot until after the trial, and had only 850 tons of coal on board, or about 300 tons short of her normal quantity, her draught was 24 ft. 2 in. forward, and 26 ft. 2in. aft, giving a mean draught of 25 ft. 2 in. This produced an immersion of the upper edges of her screws of 4 ft. 11 in., and brought the hull bodily down in the water some 2 ft. beyond her light draught, representing an increase of about 2,000 tons in the ship's displacement. Under this additional strain upon them the engines could not get away. Then the ship had been five months out of dock, so that, judging by what invariably takes place in similar circumstances, the bottom must have been foul with grass and other growths. But the most important drawback as regards speed remains to be stated. While making the first run on the mile from west to east it was found that in order to keep the ship in a straight line it was necessary to give her 18 degrees of helm. A similar phenomenon was observed during the steam trials of the *Northampton*, but in this case the required helm was permanent, and might have been necessitated by some defect of symmetry in the lines of the hull itself. In the *Inflexible*, however, the eccentricity in the steering was found to be variable, for on the first and third runs, which were made in like directions and under apparently similar conditions, the 18 degrees of helm were in one instance starboard helm, and in the other port helm. It will be seen that the revolutions of the engines did not exactly synchronize, but the difference of a revolution a minute would have no perceptible effect. The cause of the defect appeared to perplex everybody on board, some attributing it to the wind and others to the current; but, whatever the cause, it was estimated that the divergence of 18 degrees from amidships must have produced the loss of a knot in the way of the ship.

THE NEW S.S. "ROME" AND "CLYDE."

TWO splendid steamships, the *Rome* and the *Clyde*, which have just been added to the fleet of vessels, upwards of sixty in number, belonging to the Peninsular and Oriental Steam Navigation Company, were inspected lately by the directors. The steamers were berthed in the new and spacious Royal Albert Dock, which is at present the easternmost, and consequently nearest to the Channel, of the series of great docks on the north bank of the Thames. With the sailing of one of the new ships, the *Rome*, for Australia, the change of the port of embarkation for outward-bound passengers commenced, and from that day the company's steamers cease to go to Southampton, and passengers will be put on board at Gravesend. Arrangements have already been made with the London, Tilbury, and Southend Railway Company for the despatch of a special train from the Liverpool-street Station of the Great Eastern Railway for the conveyance of passengers to each steamer on the day of sailing. From the Tilbury riverside terminus of the railway passengers will be taken to the company's vessels in a river steamer. On the homeward voyage the company's steamers will call at Plymouth so as to give passengers an opportunity of saving a few hours by taking train to London. A feature in the internal arrangements of the *Rome* which will commend itself at once to most travellers is the placing of the best state-rooms, the saloon, and the music-room forward instead of aft of the engine-room. An arrangement which had its advantages in a sailing vessel, since the wind as the propelling force must, either through the stern ports or through the port-holes on one side or the other, reach the saloon fresh and untainted by the often malodorous air from between decks in the forward part of the ship, is so evidently unsuitable to the conditions under which steamers frequently make their way against a head wind or during a calm, that it is rather matter for surprise that passenger-carrying steamship companies have not generally adopted the plan of putting their best customers where they are least likely to be annoyed by the smell of cargo and engine oil. The *Rome* has accommodation for 160 first-class passengers, and it may be added that the fitting-up of the parts of the ship devoted to them appears to be all that could be reasonably wished for. The great dining saloon on the main deck, 50 ft. long, and the full width of the ship 44 ft. across, is well lighted and ventilated. The decoration of the walls with large square panels of Italian walnut, elaborately carved by Signor C. Cambi, of Siena, is something novel in a steamship. Instead of fixed bench seats, there are chairs which turn on pivots, so that passengers can take their seats or leave them, which is perhaps to most of more importance in the early days of the voyage, without disturbing others at the table. Over the dining saloon is the music room, an apartment 40 ft. long, very handsomely decorated and furnished, and, also on the upper deck, a comfortable smoking room. The state rooms are on the main deck, and near them are the bath rooms, with marble baths, and a constant supply of hot and cold water. Immediately aft of the engine rooms are saloons and cabins affording accommodation for fifty second-class passengers, for whose comfort, indeed, the provision made in the *Rome* is more complete than in the first-class quarters of the older vessels on many steamship lines. The great width of the upper deck leaves room on each side of the deck houses for a broad promenade, which will be reserved for the use of first-class passengers. The vessel has many watertight compartments, and nine separate pumps in the engine room, and there are nine boats, of which four are lifeboats and one a steam launch. Special provision, too, is made for extinguishing a fire. The principal dimensions of the *Rome* are—Length, 430 ft.; breadth, 44 ft.; depth, 36 ft.; gross tonnage, 5,100 tons; with cargo-carrying capacity of 4,000 tons. She is practically a four-decker, for there is a hurricane deck. This is 300 ft. long, and is connected with the full poop and forecastle by portable bridges. On the forecastle is a steam windlass for raising the anchor, and on the poop a steam warping engine, in addition to steam winches, four powerful steam cranes, and other appliances for rapidly taking in or discharging cargo. Messrs. Muir & Caldwell's steam gear is employed for steering. A refrigerating machine on the Bell-Coleman principle is carried. The ship is engined with two pairs of compound tandem engines of 1,000 horse-power nominal and over 5,000 horse-power indicated. There are two low pressure cylinders, each measuring 82 in. diameter, and two high pressure cylinders of 44 in. diameter. The steam pressure is 90 lb. to the square inch. Each piston rod weighs four tons, is 13 in. in diameter, and has a five-foot stroke. The massive crank shaft, of Vicher's steel, weighs 30 tons. Steam is generated in four double-ended and two single-ended boilers heated by thirty furnaces. She is fitted with four masts and two funnels. The builders and makers of the engines were Messrs. Caird & Co., of Greenock. The other new ship, the *Clyde*, which has been built and engined by Messrs. Denny Brothers, of Dumbarton, is in general arrangement similar to the *Rome*. She is, however, rather smaller, her dimensions being—Length, 390 ft.; breadth, 42 ft.; depth, 35 ft.; gross tonnage, 4,200 tons; and cargo capacity, 3,500 tons; with room for 1,100 tons of coal. She is fitted with ten watertight compartments. Her engines are of 800 horse-power nominal and 4,000 horse-power indicated. Accommodation is provided for 120 first-class and 48 second-class passengers. The saloon has been decorated from designs by Mr. Burgess, jun., of Glasgow. At a luncheon served in the large saloon of the *Rome*, Mr. T. Sutherland, chairman of the company, presiding, there were present, among others, Sir Louis Jackson, Sir George Chambers, Mr. Dodds, M.P., Mr. Du Plat Taylor, Mr. J. P. Knight, Mr. A. M. Bethune, secretary of the company, and Captain Cates, captain of the *Rome* and commodore of the company's fleet. Speaking of the progress of the Peninsular and Oriental Steam Navigation Company, the chairman said that in a very short time they would have a sister ship to the *Rome* in the Carthage, and before long a third of the same size to be called the *Shannon*, and three others, the *Ganges*, *Sutlej*, and *Thames*, of about the dimensions of the *Clyde*. This would make a total addition of something like 50,000 tons to their fleet. In order to keep pace with the improvements effected in ocean-going steamers they had within the last ten or eleven years sold vessels with an aggregate tonnage of about 80,000 tons, and had constructed new ships which, including those he had named, had an aggregate tonnage of 130,000 tons. When the new steamers were completed the total tonnage of the company's ships would be about 170,000 tons.

THE "CITY OF ROME."

THE steamer *City of Rome*, built by the Barrow Ship-building Company for the Inman fleet, arrived in the Mersey on the September 30th, after a series of trials in the Clyde, and has now taken her station on the line between Liverpool and New York. More than usual interest attaches to the incident owing to the fact that she is in point of capacity the largest vessel in the mercantile service and in engines the most powerful. Since her launch on June 14th, her progress has been watched with considerable interest by those concerned in nautical affairs, and though the present trials have not been as complete as was desired, they have proved entirely satisfactory so far as they have proceeded. A large company embarked on board the *City of Rome* from Greenock on Wednesday forenoon for the purpose of witnessing the trials of speed, the vessel having been taken round to the Clyde for that purpose, and for the adjustment of her compasses. The company included the Earl of Shaftesbury, Viscount Mandeville, Lord Headley, Sir James Ramsden, chairman of the Barrow Shipbuilding Company, Sir Henry Loch, Governor of the Isle of Man, Sir William Wiseman, Sir Peter Coats, Lady Edith Ashley, Mr. John Burns, chairman of the Cunard Company, and Mrs. Burns, Mr. Thomas Henderson, of the Anchor Line, Mr. C. W. Kellock, Mr. William Denny, Mr. Peter Denny, and many others interested in the construction and working of passenger steamers. A few short runs were made at easy speed, and the measured mile was covered under varying heads of steam, from easy up to three-quarter speed; but in the passage from Barrow, one of the minor bearings having become heated and fused, it was not deemed judicious to put the engines to their *maximum* power. Working at three-quarter speed, with 45 revolutions per minute, the measured mile was performed at the rate of 15¾ knots per hour; but as the engines at full speed will make 58 or 60 revolutions per minute, the trial gives assurance that the *City of Rome* will in practice attain her anticipated speed of 17½ or 18 knots per hour. In the series of tests the engines worked with great smoothness, and the readiness with which they could be manipulated is without parallel in implements of such huge dimensions. It was demonstrated by actual performance that the engines could be brought to a dead stop in two seconds by the turning of a single lever, and that from going full speed ahead they could be reversed to full speed astern in the incredible space of five seconds. The advantage of this promptness and handiness will be obvious in the event of any sudden emergency arising in the navigation of the ship. After the luncheon some of the visitors were landed at Wemyss Bay. The night was spent in cruising about Ailsa Craig for the purpose of exercising the engines, and on Thursday the progressive trials of speed were continued, with the results already stated. On Thursday evening the *City of Rome* sailed from the Clyde, running down Channel under easy steam at 14½ knots per hour, there being no desire to press the engines to their full capabilities until they had worked down to their bearings. Though there was a good breeze, she proved very steady and comfortable, as may be inferred when there was dancing in the grand saloon, which is furnished with a fine piano, while the dining saloon is fitted with a built in organ. All the principal apartments and the engine-room are lighted with the electric light (Swan's lamps), and the scene at night is brilliant as at-noonday.

In structural proportions and design the *City of Rome* presents a remarkable contrast to the *Great Eastern*, to which she stands next in magnitude in the mercantile marine. Brunel's vessel suggests the idea of a stately ark, with towering walls and ponderous hull, massive and stupendous rather than elegant. The conditions are reversed in this newer product of naval architecture. The *City of Rome* is of great length, of tapering form, symmetrical lines, and graceful mould, so that the inexperienced observer is scarcely able to realize her enormous dimensions. The difference of proportions between the two vessels supplies a singular illustration how scientific theory may be modified by practical experiment. In designing the *Great Eastern*, Brunel had no other guide than his scientific knowledge; there were no gradations between the puny vessels of five and twenty years ago and the leviathan he constructed; and he reckoned the length, beam, and depth on bases which the actual practice of later shipbuilding has not confirmed. The tendency of naval construction in the merchant navy is to lengthen the hulls, without in any appreciable degree augmenting the beam or the depth of the hold. This will be at once apparent by comparing the salient dimensions of these two typical vessels, the *Great Eastern* and the *City of Rome*. The length of the former is 680 ft., with her breadth of beam 83 ft., and depth 60 ft. The similar measurements of the *City of Rome* are, length 586 ft., while breadth of beam is 52 ft. 3 in. and her depth of hold 37 ft., so that while in length she closely approximates to her rival, in breadth and depth she is little more than half the magnitude. It is in these conspicuous differences of proportion that the disparity of tonnage is to be found. The *Great Eastern* is of enormously greater cubical capacity, as may be inferred from her breadth and depth; but, though less tall and bulky of hull, the *City of Rome* is still of great cargo capacity. Her tonnage is returned as being 8,826 tons; her displacement, on a mean draft of 26 ft., is 13,500 tons, and she has a dead-weight carrying power of 5,500 tons. The great length of the vessel and her beautifully modulated lines suggest to the beholder an impression of buoyant grace rather than of vast magnitude; yet her carrying power, notwithstanding her clipper bow, rounded stern, and trim masts, is greater than that of any other vessel afloat, except the *Great Eastern*.

This extreme length and comparative narrowness of beam might, perhaps, suggest some misgiving as to the strength of the hull. This doubt, however, is at once dispelled when the character of her construction is examined. From keel to deck the ribs and plates are of the strongest material, all knit together by angle irons and rivets, but the most distinctive feature of the design is the mode in which the hull is supported and stiffened by transverse sections. The bulkheads, of massive iron, extend from the keel upwards to the main deck, without any openings, except narrow ways, which may be closed by mechanical appliances at a moment's notice. These transverse sections serve the double purpose of strengthening the ship, much on the principle of the girder bridge, and of shutting out water in the event of accident. The largest distance between the bulkheads is only 60 ft., and it is calculated that more than one of the compartments might be filled with water without affecting the ship's flotation. The stern-post or frame is the heaviest single forging ever made for such a purpose, weighing 33 tons in the finished state. The framing of the vessel is of the ordinary type, though of exceptional size, each frame running from centre line to gunwale and being 60 ft. in length. She has two complete iron decks, with the lower deck complete for half its length; nine tiers of keelsons, the principal of which are carried in unbroken line through the engine-room; and the shell plating forms a complete skin, with every edge and butt fitted together with mechanical exactness.

The most interesting and striking feature of the vessel, however, is the engine-room. The problem the builders and engineers had to solve was how this stupendous ship, ponderous in her own weight, but still more ponderous when laden with 6,000 tons of cargo and probably 2,000 human beings, was to be propelled across the Atlantic at a speed of 18 knots an hour, that being the standard which the Inman Company set before themselves. It was an anxious and difficult study, but they are confident it has been solved. There was some thought of adopting twin screws, but it was finally determined to adhere to the older principle of a single screw, of 24 ft. diameter, driven by three sets of inverted "tandem" engines, working on three cranks, disposed at an angle of 120 deg. to each other. There are three high-pressure cylinders, 43 in. diameter, and three low-pressure cylinders, 86 in. diameter, with 6 ft. stroke. Steam is generated in eight cylindrical tubular boilers, fired from both ends, each 14 ft. diameter and 19 ft. long, the boilers being constructed for a working pressure of 90 lb. to the square inch. The engines are intended to work constantly at 8,000 indicated horse power, although capable of developing upwards of 10,000-horse power. The crank-shaft is a built shaft, and, together with the screw shaft, is made of Whitworth's fluid-compressed steel. The process of manufacture is believed to afford an absolute guarantee against flaws and blemishes. The shafts are cast in lengths, each from a hollow cylindrical ingot, which, while in the molten state is subjected to hydraulic pressure, thus excluding all gases, and consolidating the entire mass. The ingot is afterwards reheated and placed on a mandril, and is then forged and drawn by hydraulic power until it assumes the form of a double-collared shaft. The advantage of this process, according to its advocates, is, that not only is there better assurance of sound workmanship, but that the shaft is stronger and lighter; for instance, the *City of Rome's* crank-shaft weighs 64 tons, whereas, if of iron and solid, the weight would have been 73 tons.

The internal arrangements and appointments for the convenience of passengers and crew are of the most admirable character. The berths for the cabin passengers are spacious and airy, while those for the emigrants, of whom the *City of Rome* will carry an immense complement, are open, well lighted, and well apportioned. The saloons, boudoirs, smoking rooms, and drawing rooms are furnished in a luxurious style, with rich ornamentation and every appliance to render the voyage pleasant and comfortable. The vessel is, in fact, a floating palace, and though others of the great ocean-going steamers may rival her in this character, none excel her in luxury, while in capacity and engine power she is the present leader of England's mercantile marine.

The placing of this vessel on the station marks another epoch in the history of steam navigation, and illustrates the marvellous strides made in that science during the life of one British merchant. Mr. William Inman lived to see the *City of Rome* launched, but he was cut off by death a few weeks ago, before she was ready for sea. He was only 56 years of age at the time of his decease, yet during his comparatively brief life he witnessed—and, indeed, led—one of the most wonderful revolutions in maritime enterprise which history records. His boldness brought great prosperity to himself and his co-partners; but it was also attended by blessings to the world, and on the latter ground the facts deserve to be chronicled. The two main incidents of his career were that he was the pioneer in adapting the screw propeller to transatlantic navigation, and in tilizing steamships for the emigration trade.

AN ACCOUNT OF EXPERIMENTS MADE BY A BOARD OF UNITED STATES NAVAL ENGINEERS WITH SCREW PROPELLERS OF DIFFERENT MATERIAL AND DIMENSIONS APPLIED TO THE UNITED STATES FISH COMMISSION'S STEAMER "LOOKOUT" WITH THE HULL COPPERED AND NOT COPPERED.

By Chief-Engineer Isherwood, U.S. Navy.

From the Journal of the Franklin Institute.

(Continued from page 128.)

In the following Table No. 1 will be found the data of the experiments. The quantities therein given are so fully described as to need no further explanation,

The friction of the engine, *per se*, that is to say, the pressure required to work the unloaded engine, is taken at 2 pounds per square inch of the pistons of the two cylinders. The remainders of the indicated pressures, after deduction of these two pounds, are the net pressures upon the pistons.

In order to obtain a single expression for the indicated and for the net pressures, they have been reduced to what they would have been had the engine consisted of the large cylinder alone.

Explanation of Table No. 2.—(see next issue.)

In Table No. 2 will be found the distribution of the power during each of the experiments whose data are recorded in Table No. 1, the capital letters at the heads of the columns, in both tables, indicating experiments with the screws designated by the same letters.

This distribution is necessary in order to understand what portions of the indicated horses-power developed by the engine are expended in the different operations connected with the propulsion of a vessel by a screw.

Of the indicated horses-power a portion is consumed in working the engine, *per se*, that is to say, the unloaded engine; and this portion must first be deducted, because, until the friction of the engine is overcome, no power can be applied to the screw, or externally of the engine; for it is obvious, that until the friction of the engine itself is counterbalanced, the piston cannot move.

After the deduction of this power, the remainder of the horses-power, called the net horses-power, is applied to the crankpin and does external work. A friction attends the net power, additional to that of the unloaded engine and proportional to the net power, let the latter be what it may; and the power required to overcome this friction is the power absorbed by the friction of the load, the articulations of the engine moving under the net pressure producing greater friction on them than is due to the mere weight of the moving parts and to the pressure of the packings.

Then, there are the horses-power expended in overcoming the skin or surface resistance of the screw blades experienced from the water in which they move. This power can be calculated independently when the data are known.

There still remain to be determined the portions of the net horses-power expended in the slip of the screw and in the propulsion of the vessel. These are ascertained as follows: The sum of the powers expended in overcoming the friction of the load and in overcoming the resistance of the water to the surface of the screw blades being deducted from the net horses-power, the remainder is divided between the power expended in the slip of the screw and in the propulsion of the vessel in the ratio of the speeds of the two; the pressure exercised by the screw forward in propelling the vessel, and backward upon the receding mass of water, constituting the slip of the screw, being the same. Hence, if the aforesaid remainder of power be multiplied by the speed of the slip expressed in fractions of the axial speed of the screw, the product will be the power expended in the slip, which being subtracted from the above remainder leaves the residue as the power expended in the propulsion of the vessel.

On these general principles, the corresponding quantities in Table No. 2 have been calculated. For facility of reference, the quantities have been grouped and the lines containing them numbered.

Line 1 contains the dates of the experiments. Line 2 gives the speeds of the vessel per hour, in geographical miles of 6086 feet. Line 3 gives the slips of the screws in per centum of their speed, calculated from their pitches into the number of their revolutions made per hour, and from the speeds of the vessel on line 2. On line 4 are the thrusts of the screws in pounds during each experiment; these quantities are what would have been given by a dynamometer had one been applied directly to the screw shaft and fulcrumed on the vessel. They are calculated from the quantities on line 19, by multiplying the latter by 33,000 and dividing the product by the speed of the vessel in feet per minute. Line 5 contains the number of double strokes made per minute by the pistons of the engine, and of revolutions made per minute by the screw. The quantities on lines 1, 2, 3 and 5 are taken from Table No. 1 and added for the sake of completeness to Table No. 2.

Distribution of the Indicated Horses-Power.

Lines 13 to 19, both inclusive, show the distribution of the indicated horses-power among the operations contingent on the propulsion of the vessel by the experimental screws. Line 13 contains the indicated horses-power, the quantities being taken from Table No. 1; and line 15 contains the net horses-power applied to the crankpin, also taken from Table No. 1. Line 14 contains the horses-power expended in working the engine, *per se*, or unloaded, the quantities being the difference between those on lines 13 and 15; they can, however, be obtained independently by calculation, the data being the speed of the piston per minute in feet obtained from line 5, the area in square inches of the piston of the large cylinder alone, and the pressure on line 7. Line 16 contains the horses-power absorbed by the friction of the load; these quantities are obtained by multiplying those on line 15 by 0·075, that fraction being the coefficient of the friction of the load. Line 17 gives the horses-power expended in overcoming the resistance of the water to the surface of the screw blades. These quantities have been calculated on the assumption that a square foot of the helicoidal surface of the screws, moving in its helical path with a speed of 10 feet per second, has a resistance of 0·45 pound, which resistance increases or decreases in the ratio of the square of the helical speeds. Line 13 contains the horses-power expended in the slips of the screws, these quantities are calculated by multiplying the remainders of the quantities on line 15 after subtraction of the sum of the quantities on lines 16 and 17, by the quantities on line 3 expressed in fractions of the axial speeds of the screws. Line 19 gives the horses-power expended in the propulsion of the vessel, which power is all that is utilized of the entire power developed by the engine. The quantities are the remainders of those on line 15 after subtraction of the sum of the quantities on lines 16, 17 and 18.

Distribution of the Indicated Pressure on the Piston.

Lines 6 to 12, both inclusive, show the distribution of the indicated pressure. A single expression for this pressure being necessary, and the engine having two compounded cylinders—a small one and a large one—the desired single expression was obtained by reducing the experimental indicated pressure per square inch on the piston of the small cylinder, in the ratio of the areas of the pistons of both cylinders, and adding the quantity thus obtained to the experimental indicated pressure per square inch on the piston of the large cylinder. These are the quantities on line 6, and are taken from Table No. 1. Line 7 contains the pressure per square inch of the large piston alone, required to work the engine, *per se*. With both cylinders in use, this pressure was taken at two pounds per square inch of the pistons, and the equivalent, if applied to the piston of the large cylinder alone, was obtained by dividing 2 by the ratio of the areas of the two pistons and adding the quotient to 2, which produced the constant 2·7164 pounds per square inch, for the piston of the large cylinder alone, on line 7. Line 8 gives the net pressures applied to the crankpin, in pounds per square inch of the piston of the large cylinder alone; these quantities are the remainders of those on line 6 after subtraction of those on line 7. Line 9 contains the pressures, per square inch of the piston of the large cylinder alone, absorbed by the friction of the loads; these quantities are the products of those on line 8 by the fraction 0·075 which is the coefficient for the friction. Line 10 contains the pressures per square inch of the piston of the large cylinder alone expended in overcoming the resistance of the water to the surface of the screw blades. These quantities are the same proportion of those on line 8, that the quantities on line 17 are of those on line 15. Line 11 contains the pressures per square inch of the piston of the large cylinder alone expended in the slip of the screw. These quantities are the same proportion of those on line 8, that the quantities on line 18 are of those on line 15. Line 12 contains the pressures per square inch of the piston of the large cylinder alone, expended in the propulsion of the vessel. These quantities are the same proportion of those on line 8, that the quantities on line 19 are of those on line 15. Or, the quantities on line 12 are what remain after subtraction from those on line 8 of the sum of the quantities on lines 9, 10, 11 and 12.

The quantities on lines 20, 21, 22 and 23 are the per centum, respectively, which the quantities on lines 16, 17, 18 and 19 are of those on line 15. The quantities on lines 20, 21, 22 and 23 are also the per centum, respectively, which the quantities on lines 9, 10, 11 and 12 are of those on line 8. The quantities on lines 20, 21, 22 and 23 show, centesimally, the distribution of the net pressure and of the net power applied to the crankpin.

The quantities on line 23 express the relative utilizations of the experimental screws; that is to say, they express the per centum of the net power applied to the crankpin which the screws apply to the propulsion of the vessel. These utilizations are correct if the distribution of the net power be correct, but not otherwise. It is, therefore, of importance that the relative utilizations of the screws be obtained directly from data devoid of doubt. The quantities on line 24 express such results, and are obtained by dividing the cubes of the speeds of the vessel on line 2 by the net horses-power applied to the crankpin—line 15. The cube of the speed of the vessel expresses the useful work done, and the net horses-power expresses the power expended in doing it; the latter divided into the former gives the work done *pro rata* to power expended, therefore the larger the quotients of the divisions, that is, the larger the quantities on line 24, the greater will be the utilizations of the screws.

The quantities on line 24 afford the means of demonstrating whether the distribution of the power is correct; if it be, then the quantities on line 23 will have the same ratio to each other that the quantities on line 24 have to each other. To find if this equality exists, the quantities on line 24 were divided into those on line 23, and the quotients are given on line 25. If these quotients were equal, then the distribution of the power would be exact; if unequal, it is inexact to the extent of the inequality. When these quotients are examined, there must be recollected that they consist of two sets—one for the uncoppered hull (columns *A*, *B*, *C*, *D* and *E*), the other for the coppered hull (columns *F* and *G*); consequently, the equality referred to must be looked for only between the experiments of each set.

The fact that in the experiments with the coppered hull, its resistance was less than when it was uncoppered, makes its speed higher with a given net power than when uncoppered; and the quotients of the division of the cubes of the speeds of the vessel by the net horses-power will consequently be higher with the coppered than with the uncoppered hull. These higher quotients (experiments *F* and *G*, line 24) divided into the corresponding utilizations, or quantities on line 23, give accordingly less results on line 25 for experiments *F* and *G* than for the remaining experiments.

The near equality of the quantities on line 25 for experiments *A*, *B*, *C*, *D* and *E* with the uncoppered hull, and for experiments *F*

SCREW EXPERIMENTS.

By Chief Engineer ISHERWOOD, U. S. Navy.

TABLE No. 1, Containing the Data of the Experiments made in 1880, in the Potomac River, by a Board of United States Naval Engineers with the Different Screw Propellers applied to the United States Fish Commission's Steamer, "Lookout," for the Purpose of Ascertaining the Best Proportions of Screw for that Vessel.

		Hull not Coppered.					Hull Coppered.	
		A	*B*	*C*	*D*	*E*	*F*	*G*
	Date of experiments (a pair of runs each day)	Jan. 19, 20 & 21.	March 26, 29, & 30.	Jan. 7, 10 & 15.	April 1, 2 & 3.	June 23, 26 & 28.	Oct. 19 & 20.	Sept. 24 & 25.
	Number of runs over the base of 11⅝ geographical miles	6·	6·	6·	6·	6·	4·	4·
SPEED.	Number of double strokes made by the engine's pistons, and of revolutions made by the screw, per minute ...	152·3085	158·1988	158·8560	153·4601	140·0500	143·5402	143·4125
	Speed of the vessel per hour, in geographical miles of 6086 feet	9·5346	10·0974	9·6264	10·4190	10·1929	9·9390	9·7493
	Slip of the screw, in per centum of its speed	24·4072	13·6772	18·0439	20·1542	17·9739	21·9620	12·7150
CYLINDER PRESSURES.	Indicated pressure on the piston of the small cylinder, in pounds per square inch	37·9960	39·9330	35·906	45·7104	44·7881	39·6325	36·5380
	Net pressure on the piston of the small cylinder, in pounds per square inch	35·9960	37·9330	33·906	43·7104	42·7881	37·6325	34·5380
	Indicated pressure on the piston of the large cylinder, in pounds per square inch	8·3004	8·7000	17·618	9·5172	10·7662	9·2050	8·2954
	Net pressure on the piston of the large cylinder, in net pounds per square inch	6·3004	6·7000	5·618	7·5172	8·7662	7·2050	6·2954
	Indicated pressure that would have been upon the piston of the large cylinder had the indicated pressure upon the piston of the small cylinder been reduced in the ratio of the net area of the piston of the large cylinder to the net area of the piston of the small cylinder, and the quantity thus obtained added to the indicated pressure upon the piston of the large cylinder ...	21·9103	23·0038	20·4793	25·8904	26·8090	23·4011	21·3831
	Net pressure that would have been upon the piston of the large cylinder had the net pressure upon the piston of the small cylinder been reduced in the ratio of the net area of the piston of the large cylinder to the net area of the piston of the small cylinder, and the quantity thus obtained added to the net pressure upon the piston of the large cylinder	19·1939	20·2874	17·7629	23·1740	24·0926	20·6847	18·6667
HORSES-POWER.	Indicated horses-power developed in the small cylinder	52·4763	57·6466	51·7217	63·6080	56·8784	51·5854	47·5153
	Indicated horses-power developed in the large cylinder	32·0041	35·0624	30·6356	36·9732	38·1705	33·4487	30·1167
	Aggregate indicated horses-power developed by the engine	84·4804	92·7090	82·3573	100·5812	95·0489	85·0341	77·6320
	Net horses-power developed in the small cylinder ...	49·7141	54·7594	48·8407	60·8249	54·3385	48·9822	44·9144
	Net horses-power developed in the large cylinder ...	24·2926	27·0021	22·5927	29·2034	31·0797	26·1812	24·8556
	Aggregate net horses-power developed by the engine ...	74·0067	81·7615	71·4334	90·0283	85·4182	75·1634	67·7700

and *G* with the hull coppered, prove the principle and the constants employed in calculating the distribution of the power to be correct. No nearer approach to equality than these quantities present could be obtained from delicate laboratory experiments. With this confirmation, the data and results of these screw trials may be accepted as absolutely exact.

(*To be continued.*)

ON THE PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.*

By MR. F. C. MARSHALL, of Newcastle-on-Tyne.

(*Continued from page* 157.)

WEIGHT.—The weight of machinery, water, and fuel carried for propelling ships has not had due attention in the general of engineers.

By the best shipping authorities the writer is assured that every ton of dead weight capacity is worth on an average £10 per annum as earning freight. Assuming, therefore, the weight of the machinery and water of any ordinary vessel to be 300 tons, and that, by careful design and judicious use of materials, the engineer can reduce it by 100 tons, without increasing the cost of working, he makes the vessel worth £1,000 per annum more to her owners. That there is much room for improvement in this direction is shown by the following statement, giving, for various classes of ships, the average weight of machinery, including engines, boilers, water, and all fittings ready for sea, in pounds per indicated horse power:

	Pounds per I.H.P.
Merchant steamers	480
Royal Navy	360
Engines specially designed for light draught vessels	280
Royal Navy, *Polyphemus* class (given by Mr. Wright)	180
Modern locomotive	140
Torpedo vessels	60
Ordinary marine boilers, including water	196
Locomotive boilers, including water	60

In view of the commercial considerations before-mentioned, in regard to merchant steamers, these figures confirm the idea that the weight of machinery on board such vessels has not received the attention its importance demands.

The ordinary marine boiler, encumbered as it is by the regulations of the Board of Trade and of Lloyd's Committee, does not admit of much reduction in the weight of material or of water carried when working. The introduction of steel has reduced the weight by about one-tenth; but it will be the alteration of form, to the locomotive, tubulous, or some other type, combined with some method of forced draught, to which we must look for such reductions in weight of material and water as will be of any great commercial value.

The engine may be reduced in weight by reducing its size, and this can only be done by increasing the number of revolutions per minute. It has hitherto been the practice to treat the propeller as dependent upon the size of engines, draught of water, and speed required. This process should be reversed. The propeller's diameter depends on the column of water behind, necessary to overcome the resistance in front of it due to the properties of the vessel. This fixed, the speed will then fix the number of revolutions, which will be found much greater than is usual in practice; and from this the size of the engines and boilers will be determined.

Great saving in weight can be effected by careful design, and judicious selection and adaptation of materials; also by the substitution of trussed framing and a proper mode of securing the engine to the structure of the vessel, as worked out in H.M.S. *Nelson*, by Mr. A. C. Kirk, of Glasgow, Fig. 13, and in the beautifully designed engines of Mr. Thornycroft, Fig. 14, in place of the massive cast-iron bedplates and columns of the ordinary engines of commerce. The American engines of the earlier time might also be profitably studied, not for imitation throughout, but to see what can be done towards lightening machinery, and at the same time securing efficiency and durability. Condensers may be profitably made of plate iron, brass, or copper, due care being taken to guard against galvanic action. The condensing surface needs further consideration; in many cases it is much larger than necessary; in which case massive castings of great weight are required, and large quantities of water carried, which are not really needed.

The same may be said of the moving parts. Solidity and rigidity are great virtues in a stationary engine or machine, and weight is necessary to the locomotive for the purpose of adhesion; but in the case of a marine engine mass and rigidity may, and frequently do, become serious evils. Firstly, unnecessary mass means needless weight to be carried, unprofitable load to be propelled, and the displacement of its equivalent in freight-paying cargo; and, secondly, it means rigidity, and the setting up of a state of heterogeneity in the whole structure, consisting of ships, engines, and cargo, instead of the homogeneity which is essential to a successful working machine. In fine, the hull and engine should be as much as possible one structure; rigidity in one place and elasticity in others is the cause of most of the accidents so costly to the shipowner; under such conditions mass and solidity cease to be virtues, and the sooner their place is taken by careful design, and the use of the smallest weight of material (of the very best kind for the purpose) consistent with thorough efficiency, the better for all concerned.

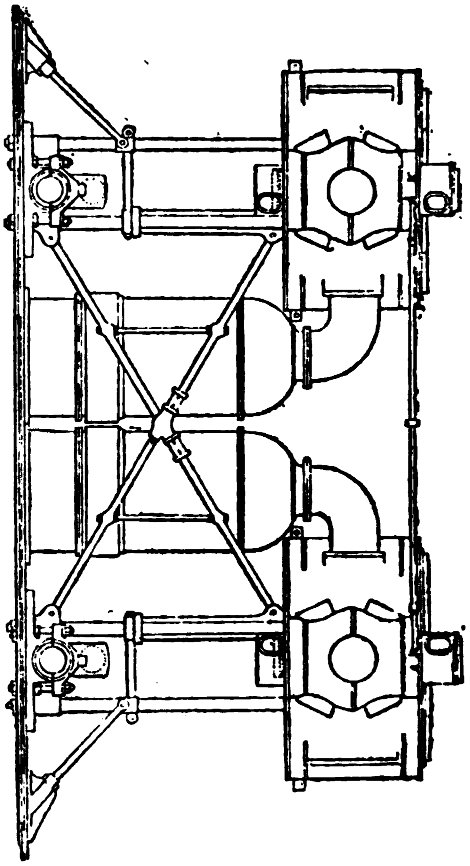

Fig. 12.

Fuel.—We come now to the question of the consumption of fuel. Referring again to Table I., we see that a considerable saving has been effected in nine years. The averages of Sir Frederick Bramwell's Table and of Table I. stand as in Table II.

This shows a saving equal to 13·38 per cent. in quantity of fuel consumed. It is right to mention that the percentage here stated by no means represents the actual saving effected in money value. The coal now supplied to steamers is of very inferior quality compared with that shipped as bunker coal prior to the coal famine of 1873 and 1874. During these years the refuse of the pits and pit heaps, and the poorest of black material, came into use, and this still holds its place firmly as bunker coal; at best, unscreened coal is supplied, where the very best screened coal was required prior to

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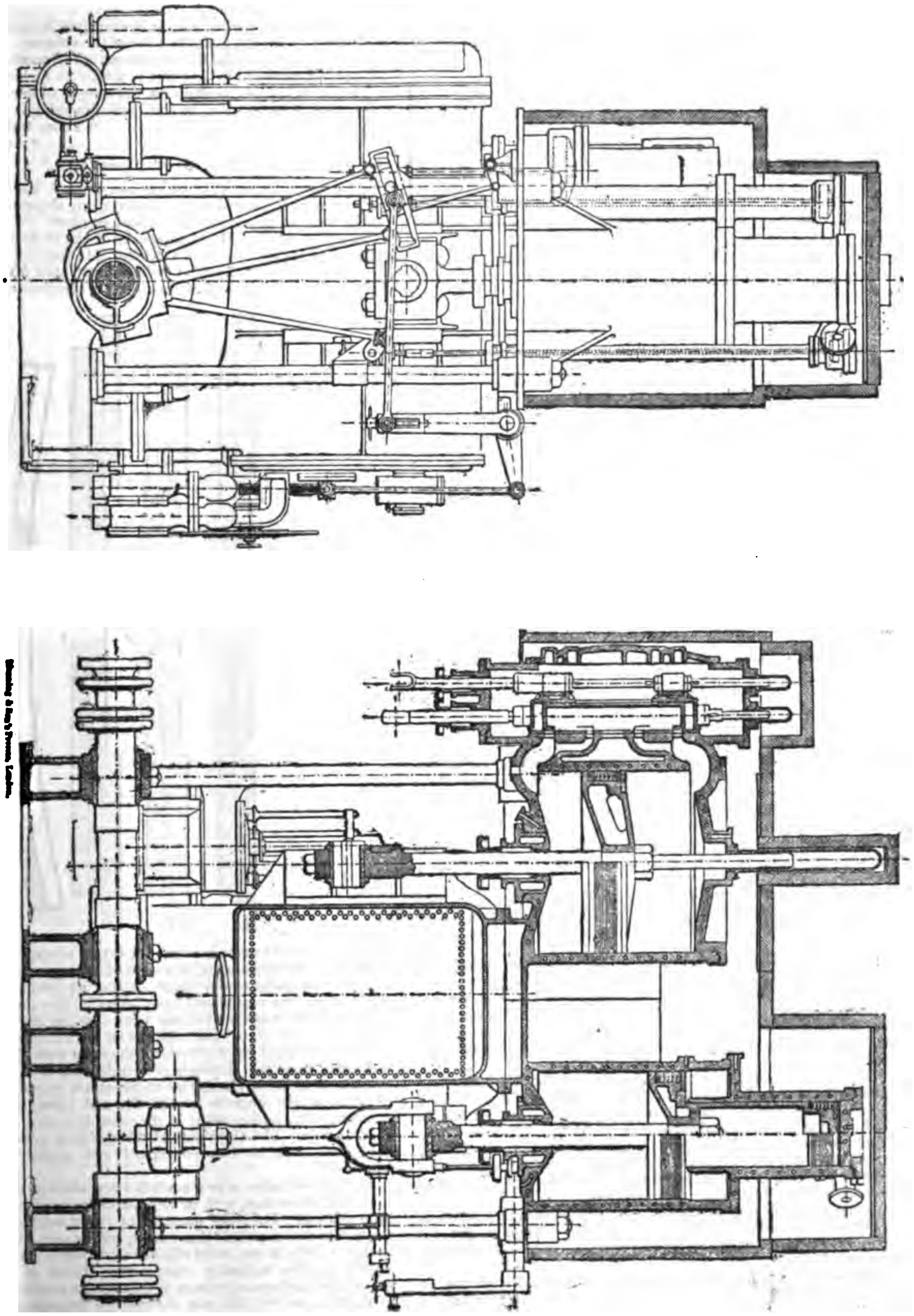
* Paper read before the Institution of Mechanical Engineers, at Newcastle.



ENGINES OF THE YACHT "WANDERER" (PERKIN'S SYSTEM).

See F. C. Marshall's Paper "On the Progress and Development of the Marine Engine."

1873. This very materially affects the question in hand, and the writer submits that it would not be unreasonable to take credit for a saving in money value of at least 20 per cent.

TABLE II.—*Comparison of* 1872 *and* 1881.

Item.	1872.	1881.
Working pressure, lbs. per sq. in.	52·5	77·4
Heating surface per I.H.P., sq. ft.	4·64	3·919
Piston speed, ft. per min. ...	376	467
Coal burnt per I.H.P., lbs. ...	2·11	1·828

The writer thinks it right to introduce at this point a letter with which he has been favoured by Mr. Alfred Holt, of Liverpool, bearing on this subject, as well as on other matters with which he will deal presently.

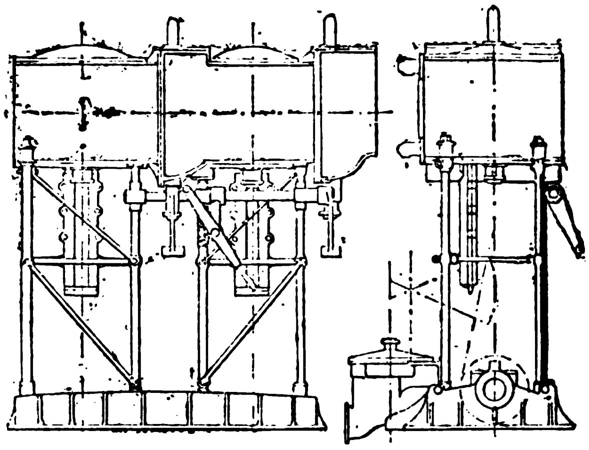


Fig. 13.

"1, India Buildings, Liverpool, June 18, 1881.

"Dear Sir,—In response to your letter of May 27, I now enclose the form you sent me, filled up with particulars of specimens of two of my best classes of ships. My vessels run in classes, so there is no occasion to give you particulars of individual ships.

"I do not think that quite so good a result as that shown in the form is generally attained on the average through the fleet; and having commenced lately to allow more steam in the high-pressure cylinders, a less economical performance naturally results.

"I think I should be able to obtain about 2·3 lb. per indicated horse power per hour over the whole, and I do not think that I have made anything more than a fractional advance in economy of fuel since 1868.

"The fact of the matter is I have not tried to do so, and I don't believe, so far as my observation extends, that mere economy of fuel is much cared for now; coals, which used to be the greatest, are becoming one of the minor disbursements of a steamer, and it cannot have escaped your notice that some modern steamers, careless of fuel, are actually abandoning both the compound system and high pressure.

"My opinion is, and for many years has been, that the compound system will come to be abandoned. I am endeavouring to feel my way to using the steam in one cylinder only, and so far the results have been encouraging; and I am now engining a 2,200-ton vessel on that system. I am also endeavouring to do without a crankshaft, the forward end of the screw-shaft carrying an ordinary crank with overhung pin. This experiment also, so far as I have got, promises satisfactorily (see illustrations next number).

"In my opinion the great improvement of the immediate future is to increase the steam production of our boilers. A ton weight of a locomotive boiler produces as much steam as 6 tons of an ordinary steamboat boiler.

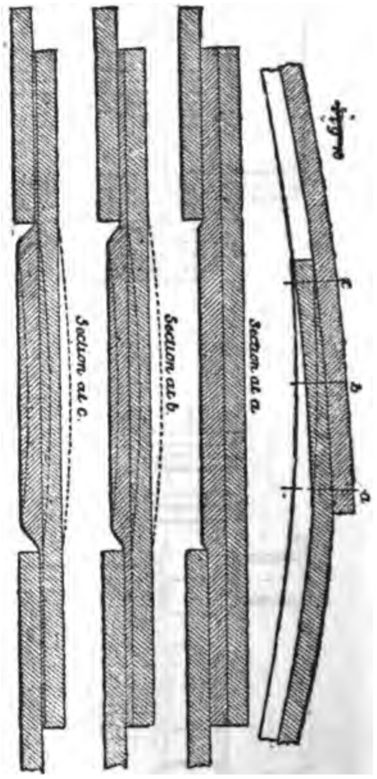
"Of course the solution lies in the possibility of (1) burning more fuel, and (2) taking the heat out of it. It is a difficult problem; a steam blast will not do it, and I am fitting a vessel with a rotary blower capable of a pressure of about 2 lb. on the inch, which shall eject air through a tapered blast pipe up the centre line of an ordinary funnel, so near the top that, before the cold ejected air destroys by its gravity the motive force it has received from the blower, and so deadens the current, it shall be out of the chimney. At the present time I am more hopeful than confident of the result, but I am convinced improvement in that line is shortly to be looked for. What a gain it would be to diminish the weight of our boilers to one-third, which is my aim in the boat alluded to.

"Yours truly,
"ALFRED HOLT.

"F. C. Marshall, Esq., Newcastle-on-Tyne."

This letter the writer considers one of great importance, coming as it does from one of our most enterprising shipowners, who is at the same time an experienced practical engineer.

It will be noticed Mr. Holt speaks of the coal account as one of the minor disbursements of a steamer. He does not give us the ratio which coals bear to the total disbursements, but from other reliable sources the writer finds that, according to the direction of the voyage, it varies from 16 to 20 per cent.—or say an average of 18 per cent.—of the total disbursements, in a vessel carrying a cargo of 2,500 tons. This will represent to-day about £3,000 per annum, and in 1872, at equal prices, the cost would have been £3,750—showing a saving of £750, equal to a dividend of say 3 per cent. on the value of the ship. Again, the cost of coal per mile run for such a vessel in 1872 would have been at least 16½d.; to-day it does not exceed 13d.

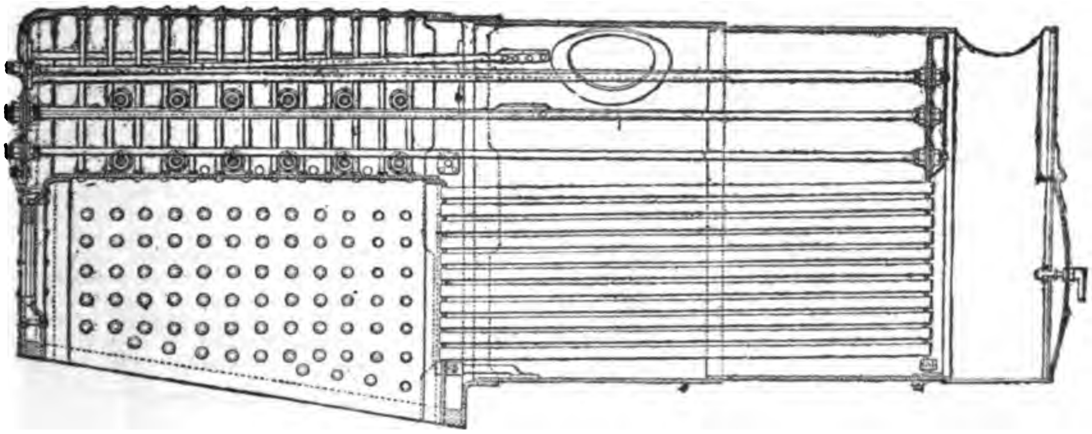


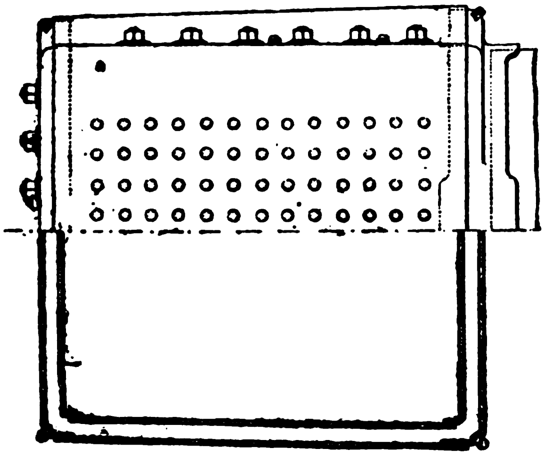
See page 155.

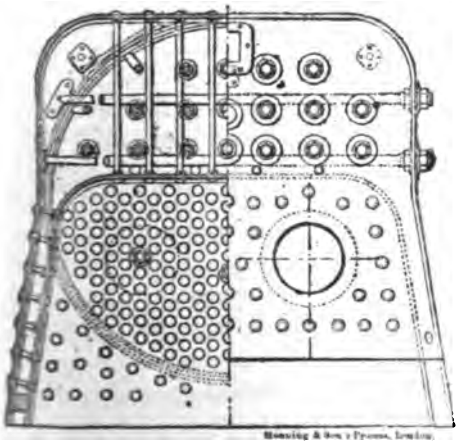
Viewed from the shipowners' stand-point this may be a minor consideration, but to the marine engineer it is important as indicating progress where progress is difficult, and taking it as such he is encouraged to further effort in the same direction.

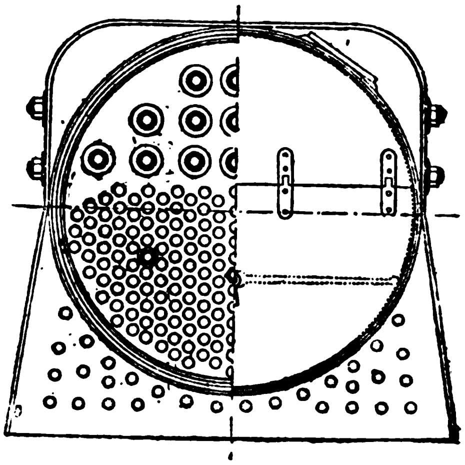
Efficiency.—The third part of this question must now be considered, viz., how to increase speed and power with safety and efficiency.

The marine boiler as now made is a very efficient machine. Tables I. and II. show that, with an increase of pressure, consumption has been reduced; but if the quantity of steam used be considered, in relation to the increased pressure, it will be seen that the boiler of to-day is little, if any, more efficient than that of ten years ago; as is shown by the following comparative Table of the calculated advantage due to using steam of the average working pressure given in Table I., or 77·4 lbs. over the average pressure of 1872, namely, 52·5 lb.









Menning & Son's Process, London.

See page 155.

The advantage is seen to be 13 per cent., which is almost exactly the same as the actual saving given in Table I., from which it would appear that our gain in consumption is solely due to higher pressure, and in no sense to increased efficiency of boiler.

TABLE III.

Calculated Net Coal and Steam used per Indicated Horse Power, for Steam of 52·5 lb. and 77·4 lb. Pressure; the same Terminal and Back Pressure being assumed in each case.

——	Effective Pressure, 52·5 lb.	Effective Pressure, 77·4 lb.
Working pressure (total) ... lb.	67·5	92·4
Number of expansions	5·15	7·0
Steam used per indicated horse power per hour ... ... lb.	21	18·17
Net coal required, per indicated horse power per hour ... lb.	1·73	1·501
Ratio of the net coal required, the amount for 67·5 lb. being unity	1	0·87
Coal per indicated horse power, taking 2·11 lb. as required at 67·5 lb.	2·11	1·835
Actual coal burnt, per Tables ...	2·11	1·828

If the evaporative performance of the marine boiler is to be increased, it must be by one of the four following methods: (1) Increase of heating surface; (2) better disposition of absorbing surface; (3) the adoption of thinner plates, or of a material having better conductive power for heat; (4) the adoption of a different and better form of boiler as a whole.

The present boiler has an evaporating efficiency of about 75 per cent., and cannot be much improved so long as air is supplied to the furnace by the natural draught, due to the temperature and height of chimney. The extent of efficient heating and grate surface is limited, and almost fixed, by the same cause.

To increase the efficiency from 75 to 82·5 per cent. would require about double the heating surface, the weight of boiler and water being also doubled, while the gain would only be 10 per cent. If it were attempted at the same time to increase the pressure, as well as the surface, relatively to the coal burnt, the addition would be somewhat less; thus, were there an increase of pressure from 105 lb. to 150 lb., then instead of double the quantity of heating surface, 1·75 of that due to the lower pressure would suffice.

Mr. Blechynden's formula, used in the writer's works for weights of cylindrical marine boilers of the ordinary type, and for pressures varying from 50 lb. to 150 lb. is as follows:

$$W = \frac{(P + 15)\,(S + D^2 L)}{C};$$

or

$$W = \frac{2\,S\,(P + 15)}{C}$$

when $S = D^2 L$, which is a common proportion.

Here W = weight in tons.
P = working pressure as on gauge.
S = heating surface in square feet.
D = diameter, in feet.
L = length in feet.
C = a constant divisor, depending on the class of rivetting, &c. For boilers to Lloyd's rules, and with iron shells having 75 per cent. strength of solid plate, $C = 13{,}200$.

This formula, if correct, and it is almost strictly so, would give the relative weight of boilers per square foot of heating surface, for 105 lb. and 150 lb. total pressure, assuming we wish to increase the efficiency 10 per cent. as follows:

$$\text{Weight at 105 lb.} = 105 \times \frac{1}{C}$$

$$\text{,, } \quad 150\text{ lb.} = 150 \times \frac{1{\cdot}75}{C} = \frac{263}{C}$$

$$\text{Hence the ratio of weight} = \frac{263}{105} = 2{\cdot}5.$$

In other words, the boiler with the higher efficiency would weigh two and a half times that with the lower efficiency. It appears, therefore, that increase of efficiency cannot be got to any useful extent by increase of surface, without such serious addition to weight as to render it impracticable, or at least unprofitable.

Next, will better disposition of heating surface, or the adoption of thinner or more conductive material, add to the evaporative efficiency?

It is difficult to see in what way much departure can be made from the present arrangement of surface. The introduction of the Fox corrugated furnace is the only step made of late years, and it promises in the future to be an effective form in which to place the material. Hitherto there have been difficulties connected with its use, but these have been in every case due to manufacture, and such as are incident to every new process. They have in no case arisen from the principle of corrugation, which must in time permit the furnaces, the best and most vital of the effective parts of the boiler, to be made of considerably thinner plate; and will thus increase to some extent the efficiency of the boiler. The use of metal of higher conductivity for the flame boxes and tubes, say copper for the one and brass for the other, would undoubtedly add greatly to the efficiency of these parts. The boilers of the Navy are invariably fitted with brass tubes, and but for the first cost of the material, and subsequent outlay for zinc, to prevent galvanic action in the iron, it would be a gain to adopt them generally.

(*To be continued.*)

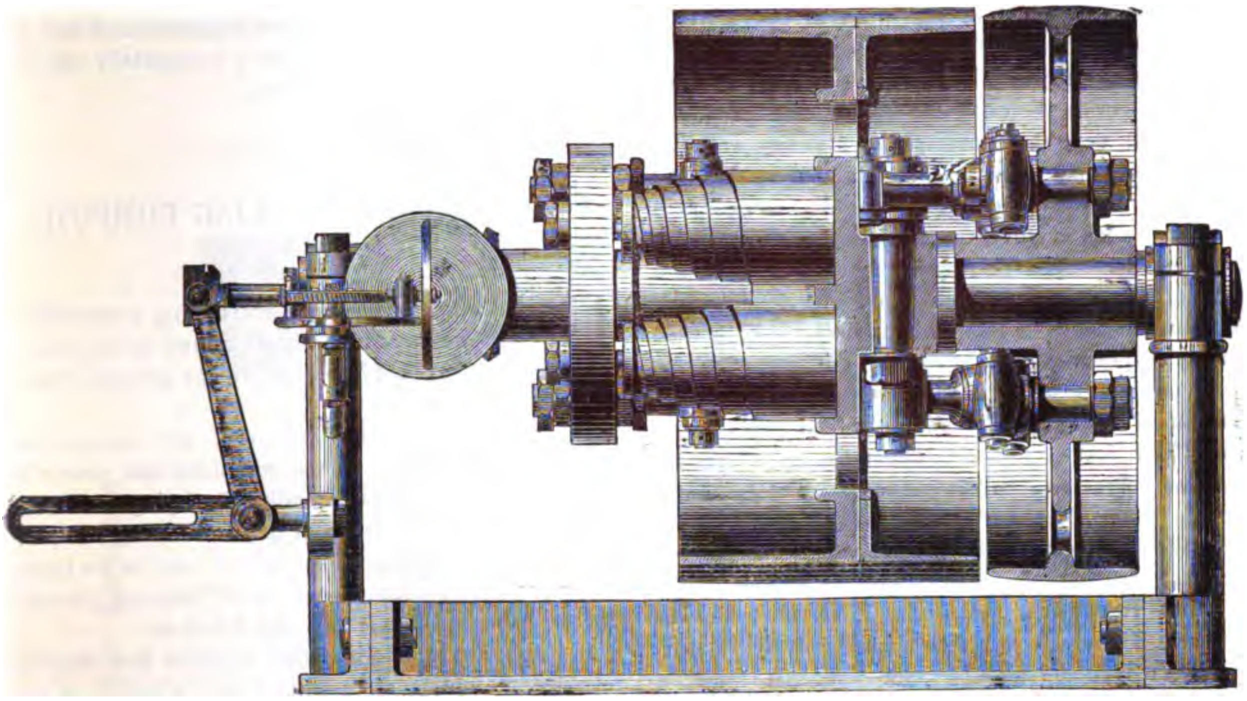
BOURRY'S DYNAMOMETRICAL GOVERNOR.

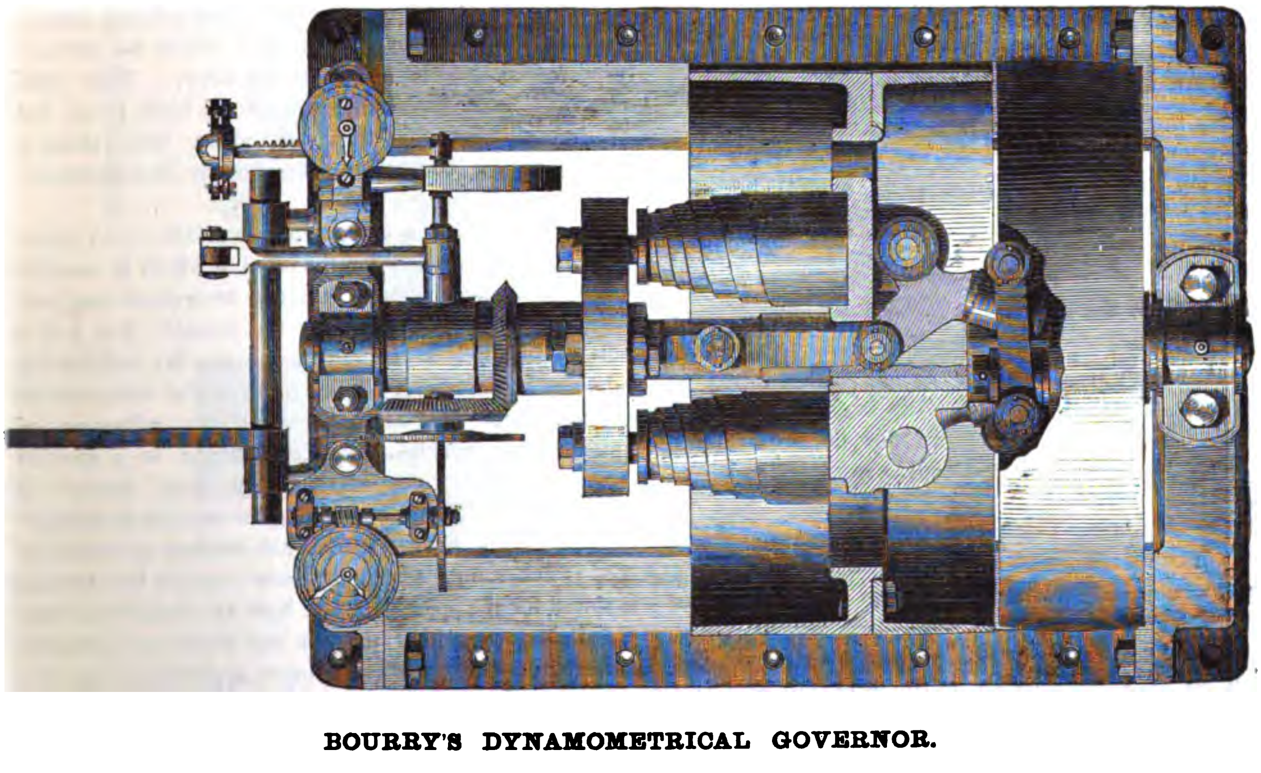
THERE are two great desiderata for the good regulation and easy working of any marine engine. The first of these is a governor which will check racing before the propeller leaves the water. The other is an elastic connection between the engine and propeller shaft.

The ordinary pendulum governor, or any other which depends upon a change of centrifugal force for its action, is perfectly incompetent to properly regulate a marine engine. This is obvious when the point is realized that to check racing the steam must be altogether cut off before there is any very sensible increase of speed. There is always sufficient steam remaining in the steam chest, cylinder and pipes, after the steam has been shut off, to enable the engine to run on whilst the propeller is out of water.

There are a few governors only, which are at present little used, that will effect such a preliminary regulation of the engine before racing has occurred. The present largely used plan for the engine to be watched and controlled by the attendant engineer, is exceedingly unmechanical and unworthy of our mechanical skill. Under the second head of an elastic medium between the engine and the propeller one or two plans have already been suggested, one in particular by Mr. Hamilton Pendred, but we do not know that they have ever been put into practical operation. The value resulting from such an apparatus must be very great, and the serious and frequent break downs of propeller shafts are invariably due to continued or sudden shock between the engine and propeller.

The inventions of Mr. Bourry, a Swiss engineer, and which we herewith illustrate, seem admirably calculated





BOURRY'S DYNAMOMETRICAL GOVERNOR.

to effect by the one apparatus both of the objects we have referred to.

Mr. Bourry's idea is essentially to convert the actual torsional resisting strain of the propeller into a direct pull in the line of the shaft. Springs of any convenient form can be inserted in this tensional pull so as to make elastic connection between the engine and propeller. At the same time the movement of a sliding collar or sleeve, not rotating with the shaft and moving with the moving end of the springs, can be utilized to operate a governor. Such a governor would gradually shut off steam as the strain decreased before any increased speed of the propeller could have developed itself. The movement also of this dynamo clutch can be used to operate dynamical indicating gear.

The mechanism for effecting this purpose is shown, in elevation and plan respectively, in our two illustrations. The first shows the apparatus as suited for stationary engine and factory purposes. The apparatus is here in the form of a counter-shaft mounted on independent pedestals and frame. One pulley (the narrowest) receives the power from the engine, whilst the other (the widest) transmits it to the plant or machine. These pulleys are connected only by a clutch. The clutch is in the form of links attached to pins on the arms of the driven pulley, which communicate the strain to bell cranks pivoted on the arms of the other pulley. The angle of each bell crank is attached to a fixed point on the driven part of the shaft by a volute spring, which enables the bell to give according to the strain. The second illustration shows the apparatus inserted in the line of the main shaft itself, as would be the case in the propeller shaft of a marine engine. A double crank is keyed to that part of the shaft bearing the propeller, and to the pins are attached two links connected to bell cranks, plainly seen in the plan. The bell cranks are centred on a fixed collar, and the other ends thrust by a pair of links upon another sliding disc on the shaft. These two collars or discs are connected by spiral springs of suitable strength. The action of the bell cranks under the torsional strain is thus to force the two discs apart, which is resisted by the action of the spiral springs. Any variety of resistance offered by the propeller is thus transmitted through the springs. There can thus be no possibility of shock in the propeller shaft or communicated to the engine.

From the sliding disc a combined rotation of a plate and a reciprocating movement is utilised to produce a variable speed of rotation of another disc, which can be used for the indication of the dynamometrical effect. At the same time a counting apparatus may be easily fitted so as simultaneously to indicate the speed of revolution.

Such an apparatus would give a most perfect and constant indication of the nett effort of an engine, and would thus at all times be a most valuable indicator. The whole arrangement is most ingenious and can be constructed of such strength that it is especially suitable for use in marine propeller shafts.

FOULGER'S ANTI-FOULING COMPOSITION.

THE value of a really good anti-fouling composition to the owners of iron vessels cannot be too highly estimated. This subject requires the personal attention of ship owners.

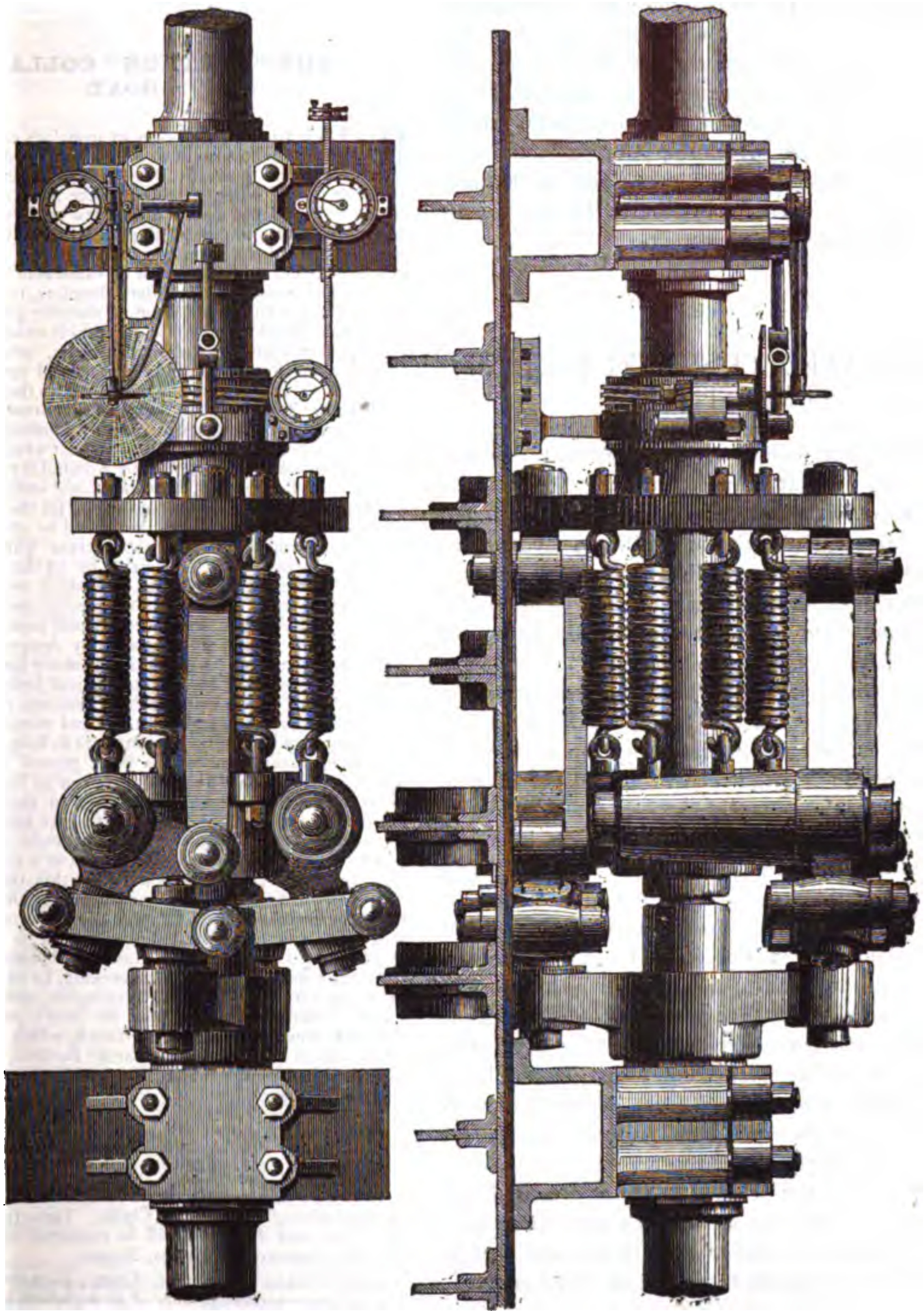
In the manner of application of any composition which they are inclined to test, too much care cannot be taken by them in superintending the laying on of such compositions, as the action of any anti-fouling composition can be entirely ruined by want of care in the laying on of the relative coats, and in the properly dry condition of the hull before any coat is laid on.

In pursuance of our intention to draw the different reliable anti-fouling compositions to the notice of our readers, we now direct their attention to Foulger's improved, formerly known as Vian's patent ferro-manganesic composition, as manufactured and supplied by Messrs. John Foulger & Sons, of Lime Street, E.C., who are the sole proprietors.

The value of this composition is, we believe, already generally known, some trials with which we are acquainted dating back as far as 1870. The chief objection to it has hitherto been its high price, but as the value of the chief ingredient has steadily decreased the composition has latterly been considerably lowered.

Messrs. Foulger's composition is divided into three different descriptions—1st, the priming which is essentially an anti-corrosive paint designed to prevent rust, and thus to protect the plates of the vessel. No. 3 is a purely anti-fouling composition with the exfoliating qualities so necessary. This part of the composition is constituted so as to prevent the adhesion of animal or vegetable substances. No. 2 is a species of intermediate composition, partaking partly of the qualities of No. 3, but having the especial characteristic of drying hard. It does not exfoliate so freely as No. 3, but stands scrubbing better, and for this reason is suited for the space between light and deep load line.

It is important that the iron hull should be perfectly clean and dry before the priming is applied, and equally necessary that each coat should be thoroughly dry before the following one is applied.



BOURRY'S DYNAMOMETRICAL GOVERNOR.

We find this firm have already supplied the composition largely to the Royal Mail Steam Packet Company for their inter-colonial vessels in the West Indies. As it is well known that these ports are most injurious in the matter of fouling and corroding of the hulls of iron vessels, it is therefore a proof of the exceptionally excellent character of the composition that it has under those circumstances given the best satisfaction. The application has also been largely made to ships of the Union Steamship Company, and it is reported that the fastest voyage ever made in that line was made by a vessel coated by Messrs. Foulger's anti-fouling composition.

VAN SPEYBROUCK'S ANTI-FOULING COMPOSITION.

ANOTHER anti-fouling composition that deserves attention is that manufactured by Messrs. Van Speybrouck, of Belgium. The agents for the United Kingdom, Messrs. Noldwritt and Murray, favoured us with a letter, which we published in our last issue, referring to a most successful trial of their composition. We can sympathize with them in the difficulty they have experienced in making shipowners grant an opportunity for a trial, but as the latter are realizing to a greater degree the necessity for a good anti-fouling composition, we should imagine they would now be more prepared to test the relative advantages of rival compositions for themselves.

The material recommended by this firm is homogeneous in its character and not of two or more diverse coatings. This, so far, simplifies the application of the paint, that there can be no confusion of coatings in the order of laying on. The coating is elastic, and will neither crack, chip, nor peel. It dries quickly, which is of considerable importance as a question of time, and also insuring that successive coats shall be dry before the laying on of the following one. It absolutely protects both iron and wood from decomposition or oxidation, and, at the same time, prevents all vegetable growth and the adhesion of barnacles.

We see, in the letter referred to, from Messrs. Noldwritt and Murray that the Admiralty's preliminary tests were spread over a period of three years, and that in the case of the composition applied in October, 1878, and redocked in April, 1880, it was found that the iron was thoroughly preserved and the bottom free from vegetation.

The coating is far better known in Belgium than in England as yet, and it has been largely used by the Belgian Government. It is cheap compared with other anti-fouling compositions, so much so as to render it suitable for painting funnels and the interior of iron ships, jetties, or any iron work specially liable to corrosion.

THE "BERTHON" COLLAPSIBLE BOAT.

RECENT trials of the boats of ironclads carrying guns of from 34 tons to 80 tons in weight have proved that ordinary boats are often, if not generally, damaged by the exhaustion of air produced by each discharge. Some of the boats of the *Neptune* were in this way rendered useless after a few rounds. But there is a far more formidable danger to ships' boats in action arising from the machine guns of the enemy, by which, (firing, as they do, a perfect stream of balls) everything that is vulnerable must be riddled in the first five minutes. In order, therefore, to provide boats that would withstand the concussion of monster guns, a 26 ft. folding galley was placed on board the *Neptune* in exactly the same position previously occupied by the wooden boats, which were destroyed; and on being shut up, whereby it presented very little surface to the disturbed air, it was found to withstand all the effects of the heavy discharges. But the other danger—that from the fire of machine guns—remained, though considerably diminished by the reduced dimensions presented by the Berthon boat when collapsed. It was then suggested to Mr. Berthon by Admiral Ryder, the Commander in-Chief at Portsmouth, that he should endeavour to provide for the big ships as he had already done for the torpedo launches—viz., construct for them boats that could be stowed under hatches and behind armour. The perfect success which has attended the bipartite dingeys which are carried by all the torpedo launches of England, France, and Austria, and which are to be supplied to those belonging to the Italian navy, encouraged the idea of making a large 31ft. cutter in three sections and capable of being stowed below. Such a craft was accordingly designed and built by Mr. Berthon at the company's works at Romsey for the *Inflexible*, and was placed on board the turret-ship just before she left Spithead for the West. It is built in three sections, each forming a complete folding lifeboat, and quite safe and seaworthy by itself. The dimensions of the entire boat are—31 ft. long, 8 ft. 3 in. wide, and 3 ft. 10 in. deep, and it has been proved capable of carrying upwards of 60 men with safety. It can be launched either united or in three parts and connected afloat, so that, should any injury occur to any one section, the other two are still available. Should the middle section, for instance, be destroyed, it could be detached, and by uniting the bow and stern sections a perfect though shorter boat be formed. In addition to all this, the entire body of the boat is divided into 24 separate watertight air cells, which render it insubmergible. The admirable behaviour of this boat in a very nasty sea was demonstrated in going out to Spithead, when Mr. Berthon was on board. Having obtained orders from the Admiralty only on the previous evening, he proceeded with a crew of 16 men from the Duke of Wellington, and soon encountered heavy, broken sea, which tried the boat's powers to perfection. Taken in tow by a large steam launch, which was swept fore and aft by almost every sea, the tripartite *Berthon*, with a long tow-line did not ship a pint of water, thus proving herself one of the driest crafts in existence.

FOUR new iron vessels are to be constructed for the Admiralty by shipbuilding firms on the Clyde. Three (named the *Misletoe*, *Watchful*, and *Arbacore*) will be entrusted to Messrs. Elder, and one (the *Arethusa*) to Messrs. Napier.

KAHNWEILER'S PATENT CORK JACKET.—The magnificent Inman Line steamer the *City of Rome*, which left the port of Liverpool on her first trip to New York, has on board 300 of Mr. Kahnweiler's cleverly-constructed cork life preservers, which have been supplied by Messrs. Watly & Co., of Preeson's Row, Liverpool, who are, we understand, the sole agents for Great Britain. The requirements of a life-belt are buoyancy, ease of adjustment, and the impossibility of displacement. These requisites are contained in this clever American invention, whilst the cost is about one-half of the ordinary life-belt.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Olivebranch.—On September 24th the second of two screw-steamers built to the order of Messrs. F. and W. Ritson, Sunderland, was launched from the yard of Messrs. William Doxford & Sons, Pallion. The steamer is 260 ft. in length, 36 ft. wide, and 18½ ft. in depth. She is both built and engined by Messrs. Doxford, has 33-in. by 62-in. cylinders, 42-in. stroke, is classed A 1, and will carry 2,200 tons deadweight. The vessel was christened the *Olivebranch.*

Reginald Hanson.—On September 24th Messrs. Short Brothers launched from their shipbuilding yard at Pallion, Sunderland, a screw-steamer, built to the order of Messrs. G. E. Wood & Sons, 30, Coal Exchange, London. The vessel is of the following dimensions:—Length, 216 ft.; breadth, 30 ft.; and 16 ft. 5 in. depth of hold, with a deadweight carrying capacity of 1,400 tons. She is constructed with a long raised quarter-deck, bridge-house over engine and boiler-room amidships, and topgallant forecastle, iron deck, water ballast, all fore and aft. She is intended for the general trade. The vessel was named the *Reginald Hanson.*

Ebbw Vale.—On September 24th there was launched from the Willington Quay yard of Palmer's Shipbuilding and Iron Company (Limited) a screw steamer, built to the order of Messrs. Morrell Brothers & Co., Cardiff. The vessel is 250 ft. in length over all, 33 ft. broad, and 18 ft. deep. She will be fitted with Palmer's engines, of 130-horse power nominal, and Emerson Walker & Co.'s patent windlass. The vessel was christened the *Ebbw Vale* by Miss Davidson.

Bretwalda.—On September 24th there was launched at Jarrow a steamer built for Messrs. Hall Brothers, of Newcastle. The dimensions are:—Length (over all), 330 ft.; breadth of beam, 39 ft.; depth of hold, 29½ ft. The vessel is so constructed that her decks are covered in from end to end, the upper deck being surrounded by an open rail; whilst she will have a freeboard of fully 10 ft. The steamer was christened the *Bretwalda.* She will carry about 3,600 tons, and will be propelled by powerful engines. The ceremony of naming the vessel was performed by Miss Hall, daughter of Mr. James Hall, one of the owners.

Empire.—On September 24th there was launched from the buildingyard of Messrs. R. and J. Evans & Co., Liverpool, a steamer for the firm of Messrs. Wm. Thomas & Co., of Liverpool, for the India and American trade. The dimensions are:—280 ft. long, 35 ft. 8 in. breadth, and 24 ft. 7 in. depth of hold, with a gross register tonnage of about 2,200 tons, and to carry about 3,000 tons, and is built to the highest class in English Lloyd's. She will have engines constructed by Messrs. D. Rollo & Sons, Liverpool, of about 1,000-horse power effective, on the compound surface condensing principle. She was christened the *Empire* by Miss Roberts, daughter of Robert Roberts, Esq., of Trefriw.

Zenobia.—On September 24th a screw steamer was launched from the iron shipbuilding premises of Messrs. Thomas Turnbill & Son, Whitehall, Whitby. The vessel was christened the *Zenobia* by Mrs. Turner, wife of the principal of the firm of Messrs. Turner, Brightman, & Co., London, to whose order she has been constructed:—Length, 286 ft.; breadth, 36 ft.; depth of hold, 24 ft. Built under the three-deck rule to class 100 A 1 at Lloyd's. Engines, 160-horse power, by Blair & Co., fitted with water ballast, iron lower-masts, steam winches, and patent windlass by Emerson Walker & Co.

Androsa.—On September 24th, Messrs Oswald, Mordaunt, & Co., launched from their shipbuilding and engineering works at Southampton, an iron sailing ship of 2,000 tons register, named the *Androsa*, built to the order of Messrs. E. F., and W. Roberts, Liverpool, and of the following dimensions:—Length, 272 ft.; breadth, 40 ft.; depth of hold, 24 ft. The ship is built with full poop, monkey forecastle, and large midship-house for crew. She is intended to class 100 A 1 at Lloyd's; also to take the highest class in the Bureau Veritas, The ceremony of naming the vessel was performed by Mrs. Gilles, wife of the captain. When fitted out the vessel will be commanded by Captain Gilles.

Dorothy Watson.—On September 26th, there was launched from the Union Co-operative Shipbuilding Yard, Sunderland, a wood schooner of the following dimensions:—Length, 86 ft. 7 in.; breadth, 21 ft, 1 in.; and the depth of hold, 9 ft. 1 in. The vessel is 99 21-100th tons register, and is classed nine years at Lloyd's. She has been built to the order of Mr. Walter Herron, of Blyth, and is intended for the Baltic and coasting trades. The ceremony of christening the vessel the *Dorothy Watson* was performed by Miss Cameron.

Ossoro.—On October 1st, Messrs Scott & Co., Shipbuilders, Cartsdyke, launched a small screw steamer of about 180 tons, built to the order of the Pacific Steam Navigation Company. On leaving the ways she was named the *Ossoro.*

Hughenden.—On October 5th, Messrs. William Gray & Co., launched from their yard an iron screw steamer of the following dimensions:—268 ft. by 35 feet. 6 in., by 19 ft. 9 in, to the order of Mr. T. Hudson, of West Hartlepool, intended for the American and Indian trade, to carry 2,500 tons. She is fitted with all recent improvements, including steam steering-gear amidships and screw hand gear aft. Patent windlass by Emerson and Walker, and four steam-winches by Clark, Chapman, & Gurney, Gateshead. On leaving the ways the christening ceremony was performed by Mrs. Roe, of Staincliffe, Seaton Carew, the vessel being named the *Hughenden.* The engines, which are 200-horse power, are to be fitted by Messrs. Blair & Co. (Limited), of Stockton-on-Tees. This is the fourth vessel built by this firm for Mr. Hudson within three years, and two others are now in course of construction at the same yard for that gentleman, to be named respectively *Hawarden* and *Hatfield.*

Sues.—On October 6th, a screw steamer was launched from Messrs. Palmer & Co's yard at Jarrow, named the *Sues.* This vessel has been built to the order of MM. d'Orbigny, and Fausten Fils, of La Rouchelle, in France, She is 285 ft. long, 36 ft. beam, and 27 ft. depth of hold. She will be driven by engines of 180-horse power nominal, and will carry 2,900 tons. The fittings are all of the most modern and improved type. This vessel is for the Atlantic and general trades, and is fitted with Messrs. Emerson Walker & Co's patent windlass.

Wasdale.—The other day another launch took place from the yard of the Whitehaven Shipbuilding Company, Whitehaven. The vessel, which was christened the *Wasdale*, has been built to the order of Mr. J. D. Newton, of Liverpool, and she is the largest sailing ship that has been built on the Cumberland coast. Her length is 275 ft.; breadth, 39 ft.; depth of hold, 24 ft. 3 in.; and she is 1,800 tons register. She is classed A 1 at Lloyd's, and 20 years in red (Liverpool).

Jessomene. - On October 8th Messrs. W. H. Potter & Son launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, an iron sailing ship, of the following dimensions:—Length, 270 ft.; breadth, 39 ft. 6 in.; depth of hold, 24 ft.; tonnage, B.M., 2,050 tons: tonnage nett register, 1,900 tons; deadweight capacity, 3,100 tons. The vessel was named the *Jessomene* by Miss Jessie Kerr Fernie. The ship has been built to the order of Messrs. Henry Fernie & Sons, of Liverpool, being the fourth vessel that Messrs. Potter have recently constructed for them. She is classed 100 A at Lloyd's, and 20 years in red in the Liverpool Underwriters' book. This vessel will be placed in the loading berth for Melbourne, and will be commanded by Captain Fisher, late of the ship *Pythomene.*

Hong Kong.—On October 8th was launched the *Hong Kong*, at the Neptune Works of Wigham Richardson & Co. on the Tyne. The owners are Wm. Milburn & Co. The christening was performed by Miss Atkins, of Leamington, Warwickshire.

Ixia.—On October 8th there was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), of Willington Quay, on Tyne, an iron screw steamer of the following dimensions, viz.:—Length between perpendiculars, 287 ft.; breadth, 37 ft.; and depth, 23 ft. 6 in. The vessel has been built to the order of J. Robinson & Co., of North Shields, and is named the *Ixia.* Her engines are supplied by the North-Eastern Marine Engineering Company (Limited), of Sunderland, and are as follows:—Diameter of cylinders, 33 in. and 63 in.; length of stroke, 39 in. She is fitted with all modern appliances, including Tysack's patent anchor.

York City.—On October 10th Messrs. William Gray & Co., West Hartlepool, launched an iron steamship, to the order of Messrs. Thomas Furness & Co., of West Hartlepool, for their line between that port and New York. Her dimensions are:—Length, 280 ft.; breadth, 40 ft.; depth, 22 ft. 6 in.; carrying capacity, about 3,000 tons. The engines, of 250-horse power, will be supplied by Messrs. Blair & Co., of Stockton-on-Tees. She will be furnished with all the latest improvements, including steering-gear patent windlass, and water condensers capable of supplying 500 head of cattle and a large number of small stock, fittings for carrying which will be arranged on an entirely new plan, enabling the steamer to carry general cargo on her cattle decks when not occupied by live stock. On leaving the ways she was named the *York City* by Mrs. C. Furness, of Brantford House, West Hartlepool.

Zuid Holland.—On October 10th, Messrs. Raylton Dixon & Co. launched from their Cleveland Dockyard, Middlesbrough, an iron screw-steamer of 2,270 tons gross register, and 220-horse power nominal, for the Rotterdam Lloyd's Mail Line between Holland and Java. The dimensions of this vessel are :—Length, 311 ft.; breadth, 37 ft.; depth, 27 ft. She is classed 100 A 1 at Lloyds, and will be fitted with cabin accommodation for first-class passengers. She carries Messrs. Emerson Walker & Co.'s patent brass cone windlass. This vessel is the sixth which has been built for the same line by Messrs. Raylton Dixon & Co., and is a sister ship to the *Utrecht* (s.), also trading between Rotterdam and Java. On leaving the ways she was christened the *Zuid Holland* by Mrs. John Bell, of Rushton-hall.

Schaldis.—On October 11th there was launched from the yard of Messrs. C. S. Swan & Hunter, an iron screw-steamer, built to the order of the Société Anonyme Anversoise d'Armement et de Transports Maritimes, Antwerp, of the following dimensions:—Length between perpendiculars, 285 ft.; breadth extreme, 36 ft.; depth of hold, 24 ft. She is fitted with double bottom in after hold and engine-room, and a large deep tank in fore hold, to be also used for cargo; four steam winches, windlass by Emerson Walker, and will be fitted with engines 35 in. and 68 in. cylinder 45 in. stroke, built by the Wallsend Shipway and Engineering Company. As she left the ways she was named the *Schaldis* by Miss Minnie Hunter.

Tredegar.—On October 13th a screw-steamer, built to the order of Messrs. Mosel Brothers & Co., of Cardiff, was launched from the Willington Quay Yard of Messrs. Palmer & Co. She was named the *Tredegar*. Her length is 240 ft.; breadth of beam 33 ft.; depth, 18 ft. The *Tredegar* is a sister ship to the *Ebbw Vale*, belonging to the same firm, which was recently launched at the same yard. She is fitted with Emerson & Walker's patent windlass.

City of Hamburg.—On October 22nd there was launched from the building-yard of Mr. James Laing, Sunderland, a handsome screw-steamer, built to the order of Messrs. Palgrave, Murphy & Co., of Dublin and London, of the following dimensions:—Length, 240 ft.; breadth, 32 ft. 6 in.; depth, 16 ft. 3 in. She will be classed 100 A 1 at Lloyd's, and will have Board of Trade passenger certificate. She has splendid accommodation for passengers, her saloon being very spacious, and fitted with polished hardwood. She is fitted with double bottom to contain 250 tons water ballast, divided into four compartments; main deck of iron, and all the latest improvements suitable for the various Continental trades in which her owners are engaged. The vessel is fitted with Emerson & Walker's patent windlass, with Higginson's steam steering-gear, and will carry 1,450 tons, with a speed of 10 knots. Her engines, of 150-horse power, will be supplied by the eminent firm of Messrs. T. Richardson & Sons, Hartlepool, and are the tenth pair supplied by them to the same owners, besides two pairs in process of construction. The vessel has been built under the joint supervision of Captain Carnegie, the company's marine superintendent, and their senior captain, J. Walsh. The vessel, on leaving the ways, was gracefully named *City of Hamburg* by Miss Margaret Laing, daughter of the builder.

Lindus.—On October 24th Messrs. Edwd. Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw-steamer built to the order of Mr. Joseph Fawcett, of Newcastle-on-Tyne. Her principal dimensions are :—Length B. P., 257 ft. 6 in.; beam, extreme, 34 ft. 6 in.; depth, moulded, 20 ft. 4½ in. She has T. Y. forecastle, bridge-house, long quarter deck, and a short poop for the cabin; has double bottom all fore and aft for water-ballast constructed on the "cellular" system. The decks, chart-house, engine skylight, cabin companion and skylight are built of iron. She will be fitted with 4 patent steam winches and donkey boiler, and will be rigged as a double topsail schooner. She has been built under Lloyd's special survey for the 100 A 1 class, and will be fitted with engines of 150 nominal horse power by Messrs. J. Richardson & Sons, of Hartlepool Ironworks. On leaving the ways the steamer was christened *Lindus*.

Angola.—On October 12th Earl's Shipbuilding and Engineering Co. (Limited) launched from their yard at Hull a fine iron screw steamer, named the *Angola*, which is intended for the mail and passenger service between Lisbon and the Portuguese settlements on the west coast of Africa. This is sister vessel to the s.s. *Portugal*, which Earle's Co. completed recently for the Empresa Nacional, of Lisbon. She is 290 ft. p.p., 35 ft. beam, and 25 ft. 6 in. deep; is spar-decked; built to class 100 A 1 at Lloyd's; is about 2,000 tons gross; will be brig rigged; has provision for 400 tons water ballast, and accommodation for 60 first-class passengers and 30 second-class, as well as third-class passengers. She will be propelled by compound engines of 220 nominal horse power, having cylinders 40 and 72 in. diameter by 45 in. stroke, and two large boilers, the working pressure of which is 85 lbs.

Virginian.—The new and powerful iron screw-steamer *Virginian*, built for Messrs. Fred. Leyland & Co., of Liverpool, for their American trade between Liverpool and Boston, has been launched from the yard of the Palmer Ship-building and Iron Company (Limited), Jarrow. The *Virginian* is the longest iron steamer or vessel of any class that has been built on the East Coast, and when completed will be one of the finest, most powerful, and capacious cargo and passenger screws turned out on the Tyne or neighbouring rivers. Her dimensions are :—Length over all, 435 ft.; breadth, extreme, 41 ft.; and depth of hold, 29 ft. 6 in. She is built to the highest class of the Liverpool Underwriters Registry, at the same time the scantling is considerably in excess of the requirements of the Registry. The steamer has three decks, all fore and aft; the upper one being ⅝ in. in thickness, with edges double, and the butts treble rivetted fore and aft, and sheathed with pitch pine. Extra care has been taken to considerably add to the strength of the bottom by means of additional depth of floor plates, and by extra keelsons at the bottom, bilges, &c. The hull is divided into eight water-tight compartments by seven transverse bulkheads of great strength. She has a long turtle back forecastle in which is provided excellent accommodation for the crew; a long midship deck house furnishes admirable quarters for the first and second class passengers and officers; while a large house aft affords protection to the store house and wheel-house, containing Hainston's patent steam steering gear, which will be worked from the wheel-house amidships by means of steel rods and bevel gearing carried aft underneath the upper deck. The vessel is to be rigged with four iron pole masts, with heavy yards on the two foremost masts. There will be 16 winches on the upper deck, one to each hold; and Emerson & Walker's patent direct acting steam windlass on the forecastle. The upper and main decks will be fitted up to accommodate cattle, and the great length of the steamer will allow ample space for 700 head; while in the hold there will be room for the stowage of over 4,000 tons of general cargo. Special provision has been made to preserve the cargo from damage from dampness, &c., by having a double ceiling and permanent dunnage, the latter in the bottom being placed six inches clear above the ceiling. The engines are made on Allibon's patent four-cylinder principle, having two high-pressure cylinders, each 29 inches in diameter, and two low-pressure cylinders, each 60 in. in diameter, with a stroke of 60 in. The engines are capable of working up to over 3,000-horse power. The crank shaft is made up of six separate pieces bolted together, an arrangement patented by Mr. Turton, of Liverpool. The shaft is 16½ in. in diameter by 20 ft. long. The shells of the boilers are made of Siemens-Martin's steel, and are constructed to bear a working pressure of 90lbs. to the square inch. The arrangements for launching so long and heavy a structure were made with the utmost care, every precaution being taken to prevent accidents. By a novel and ingenious contrivance the dog shores were knocked out by four heavy weights falling upon them. The weights, connected with a rope winch, were lead to the front of a platform erected at the head of the vessel, and the launching was performed by cutting the rope which freed the weights and allowed them to knock out the dog shores. The interesting ceremony of launching the *Virginian* was performed in the presence of several thousands of spectators by Mrs. C. M. Palmer, and among those present were C. M. Palmer, Esq., M.P., and chairman of the Palmer Company, the Mayor of Jarrow (Mr. O. H. Duffell), &c. A beautiful ebony and silver mallet and handsome chisel (placed in rich case) was presented to Mrs. Palmer by Mr. John Price, the general manager, with which the lady in a graceful manner launched the fine steamer. As the *Virginian* glided down the ways and took the water, which she did in fine style, the spectators cheered most lustily. After the successful launch, a number of invited guests adjourned to the drawing offices of the builders, where a luncheon was served in good style. Mr. C. M. Palmer, Esq., M.P., occupied the chair, and in proposing "Success to the good ship *Virginian*," said that the vessel was an evidence of the progress they were making in the construction of their mercantile marine, she being the longest steamer ever built on the East Coast. He had no doubt if they continued to make the progress in the future they had in the past few years, that in the course of time they would see ships so increase in dimensions that the *Great Eastern* would no longer be the largest ship in the world. In the manner of providing accommodation and luxurious comfort for passengers he thought the owners of their large steam-liners have shown more progress and enterprise than the managers of railways. Such steamers as the *Virginian* showed that the builders on the East Coast could turn out the highest class of work; equal to the builders of any other district. (Hear, hear, and applause.) He concluded by wishing speedy voyages to the *Virginian*, and that life might never be lost out of her, and that the Messrs. Leyland might receive that profits out of her which their spirit and enterprise deserved. (Applause.)—Mr. John Price (vice-chairman) proposed in eulogistic terms the health of Mrs. Palmer, who had so successfully launched the *Virginian*. The toast was drank with enthusiasm. Mr. C. M. Palmer in responding, referred to the novel arrangement by which the vessel was launched, and highly commended Mr. Robert Armstrong, the ship-yard manager, and his foremen and workmen, for the anxious care they had bestowed on their work. So long as the men and foremen and managers continued to work in harmony as they did in the Jarrow yard, and performed their work honestly and conscientiously, he had no fear of French bounties injuring the mercantile marine of England.

Tancarville.—An important event took place on the Tyne at Scotswood on October 22nd, in the launch of the first ship built above the bridge. An extensive shipbuilding yard was opened at Scotswood, adjoining the Suspension Bridge, in February of this year, by Messrs. Campbell, MacIntosh, & Bowstead. At first only 100 men were employed, but the number of workmen increased to nearly 600, and the spacious yard was completely furnished in every department of construction. The keel of the first vessel was laid in the middle of April, and was built to the order of Mr. C. Brown, shipowner, of Havre, for the purpose of general trade. The vessel was constructed under the spar-decked rule, and its internal arrangements are such as will afford, with alteration, accommodation for cattle and provide for passengers. Amidships and under the bridge there is a saloon, and above the spar deck there is accommodation for the captain and officers. There is provision in the forecastle for the firemen and seamen. There are provisions for water ballast in the after hold, and also in the main hold. The dimensions of the steamer are:—Length, 293 ft.; breadth, 36 ft. 9 in.; depth of hold, 27 ft. 6 in.; and the vessel will carry 3,200 tons deadweight. She is classed 100 A 1 at Lloyd's and highest class "Veritas." She is schooner rigged, with double topsails, and is furnished with four steam winches by Messrs. Clarke, Chapman, & Gurney, Gateshead, and patent windlass by Messrs. Emerson, Walker, & Co., London. She is further provided with teak chart-house and iron wheel-house amidships over hurricane deck, with two lighthouses on the look-out bridge forward. The steam gearing amidships and aft and the iron wheel-house are by Messrs. Higginson & Co., Liverpool. In the forward part of the vessel there it an anchor crane. The engines are by Messrs. Thomas Clark & Co., Elswick, and are of 270 nominal and 1,350 effective horse power. The steamer was built under the superintendence of Messrs. Ashlin & Ashbridge, consulting engineers and naval architects, Liverpool. The Scotswood firm have three other vessels in course of construction—one for Messrs. Bowstead & Co., of London, for Eastern passenger trade; one for Mr. Lund, of London, for Australian passenger trade; and another for Messrs. Wm. Milburn & Co., Newcastle. Two of these vessels are of large dimensions, one of the same size as the steamer launched recently, and the other 290 ft. in length. Immediately after the launch another keel was laid for Messrs. Wm. Milburn & Co.; and the firm hold other orders for steamers of larger dimensions, and their construction will be pushed forward as soon as possible. The number of workmen is, as we have said, nearly 600, and the firm will soon employ other 200. One drawback is experienced in the deficiency of working-class houses in the neighbourhood, but this will be speedily overcome. Between Scotswood and Benwell there is a very large portion of land admirably adapted for workmen's dwellings, and we believe that buildings will be commenced, to supply a much-felt want. The launch of the *Tancarville*—so the vessel was named—attracted much attention, and was witnessed by hundreds of people gathered in the shipyard and crowded on one ot the iron vessels in course of construction, and on all parts of the deck of the new steamer. There were two steam-tugs and river police boats in attendance, and the shipyard and offices were decorated with flags. About three o'clock, the supports having been removed, the steamer moved down the slipyard amidst the cheers of the spectators, and the vessel received its name from Mrs. Campbell, the wife of one of the partners, as it glided away. After the launch the visitors assembled in the office, where the health of Mr. Brown, the owner, with success to the ship, and also the health of the builders, was drunk. Mr. Campbell occupied the chair.—Mr. Hedley said he had great pleasure in proposing the health of the firm of Messrs. Campbell, MacIntosh, and Bowstead, and in congratulating them very much on the very successful launch all had witnessed. (Cheers.) That was No. 1—the first ship they had built above bridge—and she was, as the visitors had seen, a very large one. He hoped it was the commencement of a very successful business in that yard; and his wish was that the three partners might have health and strength to conduct in the way they had begun the business they had commenced there. (Cheers.)—Mr. Bowstead said he had to thank them on behalf of his partners and himself for the very kind manner in which they had drunk the health of the members of the firm. The greatest pleasure they had felt that way had been not merely the success of the launch, but the very kind wishes which had been expressed by so many of their kind friends and neighbours on that occasion. (Applause.)

County of Pembroke.—On October 22nd, there was launched from the shipbuilding yard of Messrs. William Doxford & Sons, Sunderland, for Messrs. William Thomas & Co., Liverpool, a sailing vessel of the following dimensions:—221 ft. long; 35 ft. breadth; and 21 ft. depth of hold; and of about 1,700 tons burthen, and of the highest class at Lloyd's. She was christened the *County of Pembroke*, by Mrs. Williams, wife of Captain Williams, who will command the ship.

Chittagong.—On October 24th, the *Chittagong (s)* was launched from the yard of Messrs. Raylton, Dixon, & Co., for Messrs. Patrick Henderson, & Co., of Glasgow, for their Rangoon trade. The ship is of the following dimensions:—Length, 285 ft.; breadth, 36 ft. 3 in.; depth, 23 ft. 3 in., and her carrying capacity about 2,200 tons, having engines of 180 h.p. by Messrs. Blair & Co. She has water ballast throughout on cellular principle, iron main and upper deck covered with teak, cabins in poop aft, long close bridge, and topgallant-forecastle, and, being built principally for the Rangoon trade, is fitted with special arrangements for loading, ventilating, and discharging. She has Harfield's patent steam windlass, and Bow and M'Lachlan's steam steering gear. Captain M'Kirdy, late of the British Indian Service, will command her, and his wife performed the christening ceremony.

Cordelia.—On October 25th, the *Cordelia* was successfully launched at Portsmouth. The christening ceremony was performed by the Hon. Mrs. Foley, wife of Admiral Foley, the Dockyard Superintendent. The *Cordelia* is in all respects a sister ship to the *Canada*, which was launched from the adjoining slip a month ago, and christened by the Crown Princess of Germany, and to the *Calliope*, the construction of which has just been commenced at Portsmouth. Her dimensions are 225 ft. in length between perpendiculars; 44 ft. 6 in., extreme breadth, and 21 ft. 6 in., depth of hold; while her load displacement is 2,383 tons. She will have a mean draught of 17 ft. 9 in., and will carry, instead of the present *Comus* armament of 14 guns, 10 guns of the new 6-inch breechloading type. She will be provided by Messrs. Rennie with a pair of horizontal compound engines, working up to 2,300 horses, and which are expected to realize a speed of 13 knots an hour, with 100 revolutions a minute.

LAUNCHES.—SCOTCH.

Thames.—On September 26th, there was launched from the yard of Messrs. James and George Thompson, at Clyde Bank, Glasgow, a screw-steamship of 4,200 tons and 5,000-horse power, for the Peninsular and Oriental Steam Navigation Company. The name of *Thames* was conferred by Mrs. George P. Thomson. The *Thames* will get her engines and boilers from Clyde Bank Foundry, and she will return to dock at Clyde Bank to be equipped and completed. She is 390 ft. long; 42 ft. broad; and 35 ft. deep; with engines of 750-horse power nominal. The vessel will accommodate 120 first-class and 48 second-class passengers, and will carry over 3,000 tons of cargo. The first voyage of the *Thames* will be on the Company's Australian line.

Antilles.—On September 26th, Messrs. Napier, Shanks & Bell, Yoker and Glasgow, launched a screw-steamer 270 ft. by 33 ft. 6 in.; and 19 ft. 3 in.; about 1,350 tons, built for Messrs. Scrutton, Sons & Co., of London, as an addition to the Direct West India Line. The *Antilles*, as the new vessel is named, has been constructed to Lloyd's highest class, with double bottom on the continuous girder system, and combines the most approved arrangements and appliances for the West India trade. Superior accommodation is also provided for a number of first-class passengers in a well-ventilated poop. The engines. 34 in. and 58 in. diameter, 36 in. stroke, are supplied by Messrs. James Howden & Co., Glasgow. At the launch the owners were represented by Thomas Scrutton Esq., David Caw, Esq., and Captain Ball. The naming ceremony was performed by Miss Campbell, of Bradford.

Cape Clear.—On September 30th, Messrs. Steele & Co., Shipbuilders, Greenock, launched an iron screw-steamer, built to the order of Messrs. A. Lyle & Sons, and intended for the Java sugar trade. She is a vessel of 2,200 tons, with engines of 200-horse power, and measured 290 ft. in length; 30 ft. in breadth; and 28 ft. in depth. It is understood that she is the first of a line of steamers proposed to be built by Messrs. Lyle, in addition to their magnificent fleet of sailing vessels. She was named the *Cape Clear* by Miss Lyle.

Professor.—On October 8th, Messrs. Scott & Co., Cartsdyke, Greenock, launched a screw steamer of 2,550 tons gross, which, as she left the ways, was named the *Professor* by Mrs. Alex. Gauld, wife of Mr. Gauld, of the Commercial Bank. The dimensions of the new vessel are:—Length, 350 ft.; depth, 28 ft.; and breadth, 37 ft. Her engines of 350-horse power, are to be supplied by the builders. She is fitted with a patent direct steam windlass by Emerson, Walker & Co., London. The *Professor* has been built to the order of Messrs. F. and J. Harrison, Liverpool.

Clydesdale.—On October 8th, Messrs. Blackwood & Gordon launched from their yard at Greenock a screw-steamer of 1,300 tons and 240 ft. long named the *Clydesdale*. This is the third new steamer built for the "Dale" Line, managed by Messrs. R. M'Kill & Co., Glasgow, and engaged in the Mediterranean trade. The *Clydesdale* is fitted with engines of 120-horse power by her builders.

Fooksang.—On October 8th there was launched from the building-yard of Messrs. Hall, Russell & Co. an iron screw steamer, named *Fooksang*, of the following dimensions:—Length, 255 ft.; breadth, 35 ft. 6 in.; depth 23 ft.; and 1,580 tons gross. This vessel has been built under special survey to class 100 A at Lloyd's, and will be fitted with compound surface condensing engines of 180 horse power nominal, steam winches, steam steering gear, patent steam windlass, water ballast, and all the most approved appliances for facilitating the loading and discharging of cargoes. The *Fooksang* has been built to the order of Messrs. Mathieson & Co., of London and China, and is specially fitted for the China trade, having large ports in 'tween decks for light and ventilation, with a light shade or sun deck extending the whole length of the vessel. As the vessel left the ways the ceremony of naming was performed by Miss M'Bain, daughter of the superintendent.

Nerbudda.—On October 10th Messrs. Russell & Co., Shipbuilders, Greenock, launched from their shipbuilding yard an iron ship of 1,550 tons nett, and of the following dimensions:—Length, 258 ft.; breadth, 38 ft.; and depth 22 ft. 9 in. The vessel, which has been built to the order of Messrs. Foley, Aikman & Co., Shipowners, London, is intended for the East India trade, and has been fitted up with all modern improvements for the rapid loading and discharging of cargo. On leaving the ways she was named the *Nerbudda*. After the launch the vessel was towed to Port Glasgow, where she will be masted and fitted out for sea.

John Ray.—On October 12th a steamer was launched by Mr. W. B. Thompson, from the Caledon Yard, Dundee. The vessel, which was named the *John Ray*, has been built for Messrs. M. A. Ray & Sons, of London. Her dimensions are—106 ft. long, 36 ft. broad, and 14 ft. deep, and the class is 100 A1 at Lloyd's. The vessel will be fitted with topgallant forecastle, bridge-house, and break poop, and will be provided with compound engines of 85-horse power nominal. The latest improvements have been introduced, such as water ballast tanks, steam-winches, steam-gearing, &c. The steamer is intended for the coal trade between London and the north of England, and is about 500 tons burthen.

Ardangorm.—On October 13th there was launched at Messrs. Ramage & Ferguson's ship-building yard, Leith, an iron screw steamer named the *Ardangorm*, 1,600 tons gross, and 2,150 tons deadweight capacity, for Messrs. M'Laren, Crum & Co., Glasgow. This vessel has been specially designed for the Mediterranean and East Indian trade, and has all the latest improvements, including steam-windlass, steam-winches, water ballast, teak deck, &c. Her dimensions are 260 by 35 by 19 ft. hold; and engines of 200-horse power nominal being supplied by Messrs. Walker, Henderson & Co., of Glasgow.

Harlaw.—On October 14th Messrs. Cunliffe & Dunlop launched from their engineering and shipbuilding works at Port Glasgow an iron screw steamer of 500 tons burthen, and 80 h.-p. nominal. Her dimensions are as follows:—165 ft. between perpendiculars; 24½ ft. beam; and 13½ ft. depth of hold. As the vessel left the ways she was named the *Harlaw* by Miss Dunlop, of Glasgow, and was immediately thereafter laid under the crane at the builders' wharf, where she will receive her machinery, which is also being constructed at Inch Works. The *Harlaw* has been built to the order of the Aberdeen Steam Navigation Company, and is intended for their cargo trade between Aberdeen and London, being fitted with all the latest applications for working. Her fittings include Muir & Caldwell's steam cranes and steering gear, and also M'Onie's steam windlass. Like the other steamers of this company the *Harlaw* is built to attain a high rate of speed.

Chi Yuen.—On October 17th there was launched from the building yard of Messrs. Lobnitz & Co., Renfrew, a screw steamer of the following dimensions:—285 by 34.1 by 24.6. As she left the ways she was named the *Chi Yuen*, by Mrs. Thomas Weir, of Shanghae. Immediately after the launch the vessel was taken into the builders' tidal dock, where she will receive her machinery. The *Chi Yuen* is the property of the China Merchants' Steam Navigation Company of Shanghae.

Illawarra.—On October 22nd, Messrs. Dobie & Co., launched from the Govan Shipbuilding Yard and iron sailing ship, built to the highest class, to the order of Messrs. Devitt and Moore, of London, for the Australian trade, and measuring fully 2,000 tons gross. As she left the ways, she was named *Illawarra* by Mrs. Carvosso, the wife of Captain D. B. Carvosso, well known in the Australian trade, who is in command.

Hermes.—On October 22nd, Messrs. Robert Duncan & Co., Port Glasgow, launched an iron sailing ship named *Hermes*, built to the order of Mr. R. R. Paterson, Greenock. The following are her dimensions:—235 by 37 by 21·6; about 1,600 tons. She is classed 100 A 1 at Lloyd's, and is intended for the East India trade.

Glenfarg.—On October 24th, there was launched from the shipbuilding yard of Messrs. Alex. Stephens & Sons, of Dundee, an iron barque, named the *Glenfarg*, to the order of Messrs. W. O. Taylor & Co., of Dundee. The *Glenfarg* is about 900 tons register, intended for the West Coast trade, and will be commanded by Captain John M'Glashan. A sister ship, to be named the *Glenshee*, is being built by Messrs. Stephen, for the same owners.

LAUNCHES.—IRISH.

Skelligs.—On September 22nd the ninth steamer, built by Messrs. Workman, Clark, & Co., was successfully launched from their recently-erected premises, Spencer Basin. This latest addition to our mercantile navy has been built to the order of the Clyde Shipping Company, and we understand that she is intended for the West of Ireland coasting trade, having special accommodation on the main deck for the transit of live stock. Her dimensions give her a gross tonnage of 500; length being 160 ft.; breadth of beam 25 ft. 6 in.; and depth of hold 12 ft. The rig is that of a fore and aft schooner, and like all Messrs. Workman, Clark, and Co.'s vessels, has been built under special survey to class 100 A 1 at Lloyd's. A raised quarter deck and top-gallant forecastle are among the leading features. In her build—and in this, as indeed in every detail of her construction—the greatest available skill and most improved methods have contributed to make her as perfect as possible. Messrs. Rowen & Sons, Limited, have had the order for the engineering requirements of the new vessel, and are about to supply her with the pair of compound, inverted, direct-acting, impact, condensing engines of about 100 horse-power, the cylinders being 20 and 42 in. diameter and 36 stroke, as well as a pair of steam-winches, and with brass cone brake windlass, Emmerson, Walker & Co.'s patent. In connection with the latter it may be mentioned that in the building and fitting out of this vessel, particular attention has been directed to the system of loading and unloading with the view to the adoption of one that would secure the maximum of both expedition and safety, and it is believed that in the arrangement now followed it will prove to be satisfactory in its working. The launch was witnessed by a number of friends of the firm, and as the ship glided from the slip she was gracefully christened the *Skelligs* in the usual orthodox fashion by Miss Pinkerton. Shortly afterwards the *Skelligs* was towed into Prince's Dock, where the engines and fittings will be put in their place. There are at present four other steamers on the stocks of this yard, one of them built to the order of the City Line of Glasgow, being over 4,000 tons, and measuring 400 ft. long, and the total tonnage of the quartette reaching over 7,300. This is a pleasing index to the activity of the trade in Belfast, and we are equally glad to know that the other large establishments are in a similar satisfactory state at the present time.

Shannon.—On October 6th a steel-built vessel was launched from the yard of Messrs. Harland and Wolff, Belfast. This new vessel has been built to the order of the Peninsular and Oriental Steam Navigation Company, and is intended for the Australian passenger trade. Her dimensions are:—Length, 450 ft.; breadth 42 ft. 6 in.; gross tonnage, 4,300. She is classed 100 A at Lloyd's, and her engines will be over 4,000-horse power. The christening ceremony was performed by Mrs. Kellock, the wife of the superintendent of the company, the vessel receiving the name of the *Shannon* as she glided from the slip.

LAUNCH.—FRENCH.

La Ville de Montévidéo.—On September 18th was launched from the shipbuilding-yard of Forges à Chantiers de la Méditerranée, at La Teyne, near Toulon, an iron screw steamer, built for the Compagnie des Chargeurs réunis du Hâvre. The dimensions are:—Length between perpendiculars, 294 ft.; breadth moulded, 35 ft.; depth moulded, 25 ft.; tonnage, net registered, 1,400 tons: She will carry about 3,000 tons, and is classed at the highest class of Bureau Veritas under special survey. She will be provided with direct-acting compound engines of 1,000 indicated horse-power by the same firm at Hâvre. Cylinders 34 and 64, with 40 in. stroke. Steam will be supplied from two large cylindrical boilers, with large heating surface and of superior construction for a working pressure of 80 lbs. The steamer is to be brig-rigged and spar-decked. She will be fitted with double bottom for water ballast, four steam-winches, and all the most recent and improved appliances for expeditious loading and discharging cargoes, patent windlass and patent steam-steering gear. In addition to superior cargo space for the conveyance of general goods, the vessel will be able to accommodate, in 'tween decks, 460 emigrants. A great improvement has been made in regard to those accommodations; a special feature in this vessel is that the berths are arranged in single instead of double tiers, each tier being separated from the next by a passage with large sidelight at the end. This adds greatly to the ventilation, light, and comfort of the passengers. The captain and officers are accommodated in houses amidships and aft. The steamer was christened *La Ville de Montévidéo* as she left the ways. She will form the third of a fleet of fine screw steamers ordered by the same firm at Hâvre.

LAUNCH.—GERMAN.

Wandrahm.—On September 28th there was launched from the yard of the Flensburg Iron Shipbuilding Company, in Flensburg, a screw-steamer of the following principal dimensions:—Length between perpendiculars, 258 ft.; extreme breadth, 34 ft.; depth of hold, 24 ft. 9 in. The vessel is spar-decked and classed in the highest class of Bureau Veritas, and she is built for the Hansa Steam Navigation Company in Hamburg. On leaving the ways she was named *Wandrahm* by Miss Catherine Jurgensen, and was afterwards taken to the sheer legs to get in her engines (160-horse power), which are also built by the Flensburg Shipbuilding Company.

LAUNCHES.—SWEDISH.

Bordeaux.—On October 21st there was launched from the Motala Company's yard at Lindholmen, near Gothenburg, a steel screw-steamer of the following dimensions:—Length over all, 203 ft.; breadth moulded, 29 ft. 6 in.; depth of hold, 23 ft. 2 in.; and with a carrying capacity of 1,000 tons deadweight. This steamer is built of Motala Bessemer steel for the Svenska Lloyd's Company, at Gothenburg, for their Mediterranean service, will be classed at Bureau Veritas, and has been designed specially for cargo with spar deck, the main deck being of iron. She was named the *Bordeaux*, and will immediately receive her engines of 110 nominal horse-power.

Kalmuck.—There was launched from the Motala Company's yard at Norrköping, in September last, a paddle river steamer named *Kalmuck*. This steamer is built for the river Wolgan, in Russia, and her dimensions are as follows:—Length, 263 ft.; breadth moulded, 28 ft. 6 in.; depth of hold, 8ft. 6 in. The machinery, of 80 nominal horse-power, is placed at the after end of the ship. A sister boat to the *Kalmuck*, the *Tartar*, left the yard a month ago.

TRIAL TRIPS.

Cilurnum.—On October 1, the trial trip took place of the *Cilurnum* (s), built by Messrs. C. S. Swan & Hunter, Wallsend, for Messrs, Elliott, Lowry, & Dunford, Newcastle, the day being fine and the trial proved highly satisfactory. The dimensions of the *Cilurnum* are 225 ft. by 36 ft., by 24 ft. 6 in. The engines are by Messrs. R. & W. Hawthorn, 34½ in. and 64 in. diameter, by 42 in. stroke, and the vessel attained an average speed of 11·63 knots at the measured mile.

Claymore.—On October 1, the new screw steamer *Claymore*, recently built by Messrs. James & George Thompson, for the Clyde and West Highland tourist traffic, went down the Firth to go through her official speed trials. The guaranteed speed of the *Claymore* was to be 13¾ knots, but on the measured mile on Saturday the mean speed attained was 14¾ knots, or one knot in excess.

Chancellor.—On October 5th the *Chancellor* (s), built by Messrs. Raylton Dixon & Co., of the Cleveland Dockyard, Middlesborough to the order of Messrs. Edward Harris & Co., Middlesborough, took her trial trip. She is of the following dimensions:—Length, 279 ft.; breadth 37 ft. 3 in., and depth of hold 24 ft. 6 in., with a carrying capacity of about 3,000 tons deadweight. She is built on the three-decked principle, having two decks laid, the main one of iron and the upper of wood. She has also water ballast in a double bottom in the after main and fore-holds, four steam winches patent steam steering-gear, &c., iron lower masts, and is schooner-rigged. Her cabins for captain and spare state rooms are placed in a short poop aft, and the accommodation for officers and engineers, under the bridge amidships. Her engines, of 180-horse power, are by Messrs. Thomas Richardson & Sons, Hartlepool, and during the trial gave every satisfaction, and Patent Windlass by Emerson Walker & Co., London.

Brunette.—On October 10th the trial trip took place of the *Brunette* (s), built for Th. Rodenacker, Esq., Dantzic, by Messrs, C. S. Swan & Hunter, Wallsend. Length, 202; breadth, 28½; depth 15½; with engines by Messrs. Black, Hawthorn, & Co., Gateshead. The vessel attained a satisfactory speed, and returned to Tyne Dock to load a general cargo.

Banner.—On October 10th the *Banner*, an iron screw steamer, about 300 tons B.M. ran her official trial trip on the Clyde, attaining a speed of fully 10 knots loaded. She has been built at Paisley for James R. Currie, Esq., by Messrs. John Fullerton & Co., and is intended for the coasting and Channel trade. Her engines are by Messrs. Scott Brothers.

Mounts Bay.—On October 10th, the spar-decked screw-steamer *Mounts Bay*, which was launched by Messrs. Schlesinger, Davis & Co., at Wallsend, about a month ago, had a trial trip. On getting out to sea the steamer's head was turned to the north, and after the engines had got into thorough working order, she was run nearly as far as Coquet Island, when she was turned and brought at full speed back to the Tyne Dock, without any hitch in the working of the machinery. The leading measurements of the vessel are as follows:—Length between perpendiculars, 290 ft.; breadth moulded, 37 ft.; depth of hold, 27 ft. 3 in. The engines for this vessel have been built by Messrs. Black, Hawthorn & Co., of Gateshead, and have cylinders 37 in. and 70 in. diameter, with a stroke of 45 in. Although something approaching a gale of wind was blowing, and the vessel so light in the water that her propeller was not much more than half immersed, an average speed of 10½ knots per hour was obtained, which was highly satisfactory under such unfavourable circumstances.

Wydale (s. s.)—On October 17th, this new steamer proceeded to sea from the Tyne, accompanied by a large party of gentlemen, and after a most successful trial trip returned in the evening to Pelaw, where she will load for Genoa. Her dimensions are—275 ft. by 36 by 23. She is three-decked, and has a central iron bulkhead running fore and aft in the holds. The main deck is of iron, with extra strengthening so as to suit her especially for the Atlantic and other ocean trades. Her cabin arrangements are extremely convenient, and reflect great credit upon the builders. She is fitted with Messrs. Brown and Harfield's steam windlass, and all other recent improvements. Her engines, which are 190 horse-power, were found sufficient to propel the ship easy at 11 knots, although the propeller was only partially immersed. During the trial, the ship was steered by Simey's direct-acting steam-steering-gear, the only noticeable features about which appeared to be its handiness and silence in working. The ship has been built to the order of Messrs. Pantland, Hick & Co., of Scarborough, who fully appreciate Messrs. Readhead's capabilities, both as ship and engine builders.

Ville de Brugie.—This small coasting steamer, built by Forrestt of London, to the order of A. Rickard, Esq., ran a satisfactory trial trip on the Thames, attaining the speed of 8¾ knots. She is built entirely of steel, having hold for cargo forward of the machinery, which consists of a pair of 8 ft. surface condensing engines, return tube, boiler, &c. Passenger accommodation is fitted aft, and there is the usual forecastle arrangement, &c. The vessel is yawl rigged, and sails for Algiers this week.

La Ville de Rosario.—This screw steamer, lately launched at La Teyne built by the Forges à Chantiers de la Méditerranée, proceeded to sea to make her trial trip on September 15th. The dimensions are 294 ft. by 35 ft. by 25 ft. The average speed of 12·50 was obtained on the measured mile instead of 11·50 stipulated by contract. The next day a trial of twelve hours' running was made to ascertain the consumption of fuel, and the result showed a rate of 1·70 lbs. per indicated horse-power, the engines indicating 1,150 horse-power, number of revolutions, 65. The result was very satisfactory to every one connected with the construction or with the ownership of the steamer, and the engines worked during the whole trip with perfect smoothness. The *Ville de Rosario* immediately left La Teyne and proceeded to Hâvre, where she will load for South America.

Terge Viken.—The trial trip of this steamer, which was launched a few weeks ago from the Motala Company's yard ot Lindholmen, near Gothenburg, to the order of Consul Peterson, of Moss, Norway, took place on the 8th inst. under very favourable circumstances. The *Terge Viken* left the next morning for Königsberg, which port was reached in 50 hours. In length the *Terge Viken* is 159 ft.; breadth moulded 24 ft. 10 in; depth of hold, 15 ft. 6in. She is built to class at London Lloyd's, with raised quarter-deck, and will carry 600 tons deadweight. The engines are on the compound surface-condensing principle, of 50 nominal horse-power, and will give the speed of eight knots on load line.

Brahma.—On October 15th the twin screw steel steamer *Brahma* left the yard at Lindholmen, near Gothenberg, where she has been built, for a trial trip in the bay. This steamer, which is built for a company in St. Petersburg for their petroleum trade between Baku and Astrakan across the Caspian Sea, is of the following dimensions:—Length over all, 252 ft.; breadth moulded, 28 ft. 6 in. The machinery, of 120 nominal horse-power, worked very satisfactorily, the speed attained was little more than 10 knots, with a boiler pressure of 64 pounds per square inch. The material in hull and boilers is of steel from the Motala Company's own Bessemer works. This is the fifth steamer for the Baku petroleum trade built at Lindholmen, and which have to be taken in two separate piecesa through the Marine Canal to Wolgan.

Reviews.

Iron Founding.—By Claude Wylie: Published by Thos. Reed & Co., Sunderland.

This is a practical book by a practical man, and has been much wanted in manufacturing circles. The moulder and founder learn their trade by years of constant observance and practice, but they will do well to learn and analyze, and reason upon the processes they are in the habit of conducting, so as to be ready in meeting unusual conditions, or in rectifying unexpected results. The student in mechanical engineering has hitherto been very much at a loss for such information as is contained in this text-book, and will obtain a great deal of valuable information from it. The subject matter deals with all varieties of compositions of moulding sands and loam, much of the information therein contained being likely to prove of great value even to manufacturers and founders themselves. The precautions to be observed in running metal into the moulds in order to ensure sound castings are amply dilated on and explained. The composition of the iron suitable for producing a definite quality of casting is duly set forth, and excellent information is given as to the management of the cupola and fans or blowers. That valuable material, malleable cast iron, is also treated of, about which not much information can be obtained elsewhere, and, altogether, there is no department of founding in which the details are not clearly and plainly described.

British Wild Flowers.—By Frederick A. Messer: Published by David Bogue, of Trafalgar-square.

Botany is a subject that is most difficult to be acquired, from the enormous variety of orders and families that have to be classified and retained in the memory. The eye should be a great assistance to the memory in recalling the arrangements and classifications of such orders, if they are presented in a clear and graphic table. This object Mr. Messer may be certainly said to have attained by his very graphic tabulation of the distinctive characteristics of the different orders in distinct columns of shrub, calyx, petals, fruit, and leaves.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—Ed.]

To the Editor of The Marine Engineer.

Sir,—Your correspondent "Wave" in your September part does not seem to be aware there is a Sea-Going Engineers' Association, but I have not noticed any improvement due to it much, as the craft needs to be improved. They have lately taken unto themselves a solicitor; he may exchange some of his ideas for theirs as they seem to be men of very few ideas,

Yours,

Sunderland, October 12th, 1881. Landsman.

To the Editor of The Marine Engineer.

Sir,—"Young Third" may find the pitch of his propeller in the following manner:—Take a piece of half-inch board, and shape it so that it is a right-angled triangle, the hypothenuse of which is the widest part of propeller blade. If the propeller is a true screw the hypothenuse will be a straight line, but if of increasing pitch will be slightly curved, and the board must be made to fit this curve. Get whole circumference of propeller and say—As perpendicular of triangle is to whole circumference, so is base of triangle to whole pitch.

Yours,

Sunderland, October 10th, 1881. Wave.

To the Editor of The Marine Engineer.

Sir,—In your impression of October 1st, you state in your "Editorial Notes" in reference to the improvements in the Navy, that "greater inducements is to be offered to young engineers of good education who have served a practical apprenticeship with private firms." Now it seems that engineers for H.M. Navy are not admitted after 16 years of age, and must undergo a course of instruction in a Naval Dockyard, and that is the only way of gaining admission, so I am informed by the secretary of the Admiralty about a fortnight ago. I always understood that if you passed the necessary examinations you would be admitted. As I am serving my time in a private firm on the Clyde, and have been undergoing a course of instruction which I thought would be the means of me joining the navy.

Perhaps you would be so kind as to enlighten me a little on the subject, and I shall feel very grateful, as I am undecided how to act.

I am, Sir, your obedient servant,

D. L.

Glasgow, October 21st, 1881.

[Your information is quite correct as to the present regulations. It is to remedy this apparent injustice to pupils of private firms that the extension of admission to H.M. Navy by examination, is now under the consideration of the Admiralty.—Ed.]

ANTI-CORROSIVE AND ANTI-FOULING COMPOSITION.

To the Editor of The Marine Engineer.

Sir,—I have read the letters of "Ex-Naval Officer" and "Ex-Mail Boat Officer," on "Anti-Corrosive and Anti-Fouling Compositions" for iron ships' bottoms in your last number with a good deal of interest, as they were evidently written by men practically versed in the subject.

Being myself an old mariner, and now largely interested, in a pecuniary point of view as a ship-owner, in this all important question to ship-owners, I shall be glad if the subject obtains a thorough investigation in your valuable pages, for the benefit of those of your readers, who like myself, "want their money invested in good bottoms."

I fully endorse all that "Ex-Naval Officer" says of the slovenly manner in which, as a rule, the work of coating the bottoms of ships, is done by the dry dock people, whose aim, it would appear to be, is to get the paint *on* and *off* again as quickly as possible.

The firm of which I am a member appear to have no difficulty in the matter, due, I suppose to the strict instructions they give their superintendent, to have the work well done, and to see that ample time be allowed for the priming or anti-corrosive coats to dry before the application of the finishing or anti-fouling coating.

The vessels maintain their high rate of speed very uniformly on their voyages out and home, and their bottoms are clean and in good order when they return, but, above all, the iron plate sappear to be thoroughly well preserved from rust or scale.

The compositions used are very excellent in their anti-corrosive and anti-fouling properties, and they are also very durable.

I do not suppose that these compositions are very widely known, or most certainly there would be less complaint amongst ship-owners of the foul state of their ships on their return home after a long voyage. I trust, however, their merit will gain for the manufacturers the reward they desire and deserve.

I may perhaps be doing good to my neighbours if I describe the *modus operandi* adopted with our ships.

Starting with a new ship, care is taken that every particle of scale in the iron is removed from the plates, *by hammering, not scraping*. Several coats of the anti-corrosive paints, as mentioned above, are then applied one upon the other, each coating being allowed to dry hard before the application of the next. By these means no oxydation of the iron can possibly take place. The anti-fouling coating is finally applied, which does not dry hard, but remains tacky on the surface, I am informed, purposely so compounded in order to prevent the adhesion of barnacles to weed.

The next time the ship is docked she is scrubbed down—scrapers are generally not necessary, or, if used at all, care is taken that the foundation paints are not disturbed. Should they, however, have been rubbed off from any cause, the bad places are made good with the anti-corrosive composition until the surface of the ships' bottom is uniformly good again. The bottom is then done all over with one or two good coatings of the anti-corrosive and finished with the anti-fouling composition. After a time the bottom becomes thickly coated with a good preservative compound and no trouble is experienced so long as the use of scrapers is ignored, and ordinary care is taken when fresh applications of the compositions are required.

I am, Sir, Yours faithfully,
OLD SALT.

To the Editor of THE MARINE ENGINEER.

SIR,—Would you kindly insert this in your November number,
And oblige,
JAMES KEMP,
Chief Engineer, s.s. *Gordon Castle.*

Port Said, Sept. 30th, 1881.

Gordon Castle.—The Castle Line of Tea Steamers, s.s. *Gordon Castle* of a gross tonnage of 2,020 tons, having had new boilers, engines overhauled, and ship re-classed, sailed from Royal Albert Dock, London, September 18th, 1881. Mean draught of 20 ft. 6 in. encountered a heavy "gale" in the Bay of Biscay for two days, still averaged over 11 knots to Port Said; from Gibraltar to Port Said with fair steaming averaged nearly 12 knots per hour. Loaded with tea she ought to maintain a speed of 12 knots. Although pioneer, and smallest of Messrs. T. Skinner & Co.'s line of "tea clippers" to and from China, will be one of the fastest of their fleet.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 20th September to 20th October, 1881.

4045 J. H. Clasper. Light rowing boats.

4057 H. E. Newton (communicated by Society Universelle d'Electricité Tommasi). Continuous electric currents in steam boats, &c.

4058 H. H. Lake (communicated by J. B. Heuck). Electrica cables.

4081 J. Challender. Safety valves.

4082 L. Shaw & P. T. Fletcher. Generator furnaces.

4093 E. G. Brewer (communicated by P. B. Delany & E. H. Johnson). Electric cables.

4098 W. Ireland. Economizing fuel and consuming smoke.

4117 G. Allix, jun. Self-filling and emptying skeps.

4146 G. Burt. Artificial fishing bait.

4154 J. G. Thomson (communicated by W. J. F. Thomson) Valves.

4155 Construction and propulsion of vessels.

4156 A. Longsdon (communicated by A. Krupp). Floating batteries.

4157 F. H. & F. A. Hamilton. Deck lights.

4178 C. C. Abel (communicated by A. Estrade). Steam superheating apparatus.

4180 C. W. King. Steam boilers, fireplaces, and combustion chambers.

4189 E. Latham. Steam-winches.

4190 H. S. Swift. Steam-engines.

4192 J. H. Johnson (communicated by P. Archer). Ventilating ships.

4198 W. R. Lake (communicated by H. Reusch). Armour plates.

4210 S. Pitt (communicated by R. P. Pictet). Construction of boats and vessels.

4211 R. H. Brandon (communicated by Gatling Gun Co.) Marine gun cartridge feeder.

4236 H. J. Haddan (communicated by I. F. Baudet). Boiler incrustation preventive.

4253 J. McMillan. Feeding fuel.

4262 R. Verdin. Appliances on flats for transhipping salt or coal.

4263 G. Wainwright. Steam boiler dampers.

4265 P. G. B. Westmacott. Rotary valves.

4270 E. A. Brydges (communicated by G. Gregersen). Pneumatic construction of pier foundations.

4274 J. A. Timmis Stowing and lowering ships boats.

4275 J. L. Rastrick. Steam boilers.

4276 C. Pieper (communicated by A. Knaudt). Steam boilers

4278 H. Goatley. Sliding seats for rowing boats.

4295 H. E. Newton (communicated by J. Ericsson). Steam engines.

4321 J. Jones. Screw-propellers.

4335 W. R. Kinipple. Construction of submerged structure.

4337 W. R. Kinipple. Propulsion of vessels.

4345 J. Rigg. Transhipment of coal, salt, corn, &c.

4347 J. Shepherd. Smoke consuming fire-box.

4354 J. Carr. Screw propellers.

4359 D. Young. Rotating shaft speed indicator.

4416 F. Hudson. Steam generator furnaces.

4427 E. G. Manbey. Pipe joints.

4440 A. Budenberg (communicated by C. F. Budenberg & B. A. Schaeffer). Indicators.

4451 P. Brotherhood. Discharging torpedoes under water.

4476 A. Simey. Boat detaching gear.

4485 G. Stevenson. Steam boilers.

4510 P. Turner. Governors.

4517 M. Hedicke (communicated by H. Gravel). Propelling vessels.

4523 J. Gallic. Lubricators.

4529 F. H. T. Engel (communicated by J. Eggers). Automatic revolution indicator.

4537 S. Hallam & J. W. Shepherd. Feed water apparatus.
4545 G. Hill. Steam boilers.
4546 E. Crompton & J. S. Cochran. Steam boilers.
4547 E. Crompton & J. S. Cochran. Water-tight sliding bulk head doors.
4550 R. Mills. Steam generators.
4560 S. Fox. Steam boilers.
4573 W. R. Lake (communicated by A. Holmes). Life boats and oars.
4580 J. Schwartz. Sounding apparatus.
4582 A. M. Clark (communicated by J. de Chanzy). Supply of electricity for lighting on steam boats, &c.

⁂ Any information regarding these or other patents will be gladly furnished on application.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

September 24th, 1881.

Allan, Percival	1 C	N Shlds.
Barker, John	1 C	do.
Bell, William	2 C	Lvrpool.
Campbell, Archbld.	1 C	London.
Chisholm, George	1 C	Glasgw.
Craig, John	1 C	Lvrpool.
Cromack, John H.	1 C	N Shlds.
Fraser, Alexander	1 C	Glasgw.
Gardiner, William	1 C	do.
Glanston, James	2 C	do.
Grant, Peter	1 C	N Shlds.
Gray, Robert	2 C	Glasgw.
Hodge, William	2 C	do.
Holliday, Robt. V.	2 C	London.
Howat, John	2 C	Lvrpool.
Ivison, Thomas	2 C	Glasgw.
Kelly, Robert	1 C	do.
Kidd, William J.	2 C	do.
Kok, Henri W.	2 C	do.
Maguire, Thomas	1 C	do.
McAllister, Charles	1 C	do.
McCall, Benj.	2 C	do.
McIntyre, Daniel	2 C	do.
McMillan, Wm. J.	2 C	do.
Moses, A. M.	2 C	N Shlds.
Muir, David	2 C	do.
Outwin, Jno. Thos.	1 C	London.
Orr, Joseph	1 C	Belfast.
Patterson, John	2 C	Lvrpool.
Ramsay, Alex. W.	1 C	London.
Robertson, Alex.	1 C	Glasgw.
Robertson, James	1 C	do.
Robinson, William	2 C	Hull.
Roach, John B.	2 C	N Shlds.
Samuel, James	1 C	Glasgw.
Smith, George	2 C	do.
Snaith, Thomas F.	1 C	N Shlds.
Sprott, Robt. Wm.	2 C	London.
Swan, George	2 C	Lvrpool.
Tardif, Frederick	1 C	London.
Tinsley, Gervase J.	2 C	do.
Tose, Thomas	2 C	Hull.
Wharrier, John	1 C	London.
Williams, Jas.	2 C	do.
Williamson, Jas.	2 C	do.
Wilson, Archibald	2 C	Glasgw.
Wright, Geo. Wm.	2 C	N Shlds.

October 1st, 1881.

Annison, Thos.	1 C	Sndrlnd.
Baser, Wm. John	2 C	N Shlds.
Blanche, Robt. P.	2 C	do.
Brown, Thomas	2 C	do.
Buckley, A.	1 C	Lvrpool.
Carey, David	2 C	N Shlds.
Cook, John	2 C	N Shlds.
Edgar, John R.	1 C	Sndrlnd.
Elrick, John C.	1 C	N Shlds.
Green, Henry L.	2 C	do.
Greig, Wm. E.	2 C	Dundee.
Jones, John S.	1 C	Lvrpool.
Jones, Samuel E.	2 C	do.
Lewis, John	2 C	N Shlds.
Robson, David	1 C	Sndrlnd.
Scragg, Samuel	2 C	Lvrpool.
Smith, John W.	1 C	Sndrlnd.
Steege, Franz A. A.	1 C	do.
Thornton, Jas. F.	2 C	do.
Webber, Charles	1 C	Shmptn.
Williams, Walter	2 C	Lvrpool.

October 8th, 1881.

Allan, James	2 C	Glasgw.
Bell, William	1 C	N Shlds.
Beynon, Jsph. R.	2 C	Bristol.
Brown, Robert	2 C	Grnock.
Campbell, Robert	1 C	Glasgw.
Colville, James	2 C	Lvrpool.
Cromarty, James	2 C	Grnock.
Denness, Robert	2 C	Grnock.
Dykes, John B.	2 C	N Shlds.
Ellis, Robert	2 C	do.
Findlay, James	2 C	Lvrpool.
Graham, James L.	2 C	N Shlds.
Grant, George	2 C	London.
Heslop, William	2 C	N Shlds.
Hildreth, Geo. A.	1 C	Grnock.
Johnston, Wm.	1 C	Glasgw.
Kiddie, John	1 C	N Shlds.
Lawson, Josph. D.	1 C	do.
McCall, James	1 C	Glasgw.
McCowan, Alex.	1 C	London.
McIntyre, John	1 C	Glasgw.
Murton, Wm. Thos.	2 C	Lvrpool.
Proctor, James	2 C	N Shlds.
Richards, Geo.	1 C	Plymth.
Stewart, James	2 C	Glasgw.
Simpson, Wltr. F.	2 C	Lvrpool.
Thompson, Louis	2 C	N Shlds.
Watson, James	1 C	Glasgw.
Watt, Robert D.	2 C	do.
Ward, John	2 C	London.
Williams, Thos. E.	2 C	Lvrpool.

October 15th, 1881.

Auld, John	1 C	Glasgw.
Allen, James	2 C	do.
Bayley, Thomas	1 C	Lvrpool.
Bernard, Thomas	2 C	Leith.
Bowie, William	2 C	Glasgw.
Black, William	2 C	Leith.
Bunting, Geo.	1 C	Lvrpool.
Burlinson, Wm. A.	1 C	N Shlds.
Coulthard, Thos.	2 C	do.
Craggs, William	2 C	do.
Dawson, Wm. D.	2 C	Lvrpool.
Ditchburn, Wm.	2 C	London.
Elder, John	2 C	Leith.
Garden, William	2 C	London.
Gardner, Walter	2 C	do.
Gilchrist, Charles	1 C	Glasgw.
Gough, George	2 C	London.
Hall, Samuel	2 C	Lvrpool.
Hodge, Alex. D.	2 C	Glasgw.
Kinghorn, John	2 C	do.
Melsom, Ludvig	2 C	Lvrpool.
McEwan, John	2 C	Leith.
McFarlane, James	1 C	London.
McLean, Dnld. C.	1 C	Lvrpool.
McIntosh, Wm. W.	2 C	N Shlds.
Peed, Christpr. B.	2 C	Lvrpool.
Partington, T. R.	2 C	London.
Prentice, John	2 C	Leith.
Reid, John	2 C	do.
Scott, George T.	1 C	London.
Taylor, Charles	1 C	do.
Telford, Ed. G.	1 C	N. Shlds.
Turner, Alfred	1 C	Cardiff.
Vaughan, Chas.	1 C	N Shlds.
Walker, Robt. G.	2 C	Lvrpool.

October 22nd, 1881.

Bainbridge, F. G.	2 C	N Shlds.
Blancken, Wm.	2 C	London.
Bruce, George	2 C	Dundee.
Campbell, A.	2 C	Lvrpool.
Crawford, John P.	2 C	do.
Craik, Thomas	2 C	do.
Dawson, John	2 C	Abrdeen.
Grant, Robert	1 C	N Shlds.
Gibson, David	1 C	do.
Innes, Wm. B.	2 C	Dundee.
James, Wm.	1 C	N Shlds.
Kidd, Frank	1 C	do.
Kerr, James	2 C	London.
Maxwell, Chas.	2 C	do.
Marr, David	2 C	N Shlds.
M'Cracken, J. W.	2 C	Lvrpool.
Mills, William	2 C	N Shlds.
Mackie, Chas. S.	1 C	do.
Nairn, Robert	1 C	Glasgow.
Owens, Geo. W.	1 C	Plymouth.
Prest, Mtthw, A.	1 C	N Shlds.
Porteous, John	1 C	do.
Reid, Thos. H.	2 C	Aberdeen.
Riddle, Jas.	1 C	N Shlds.
Ritson, Maurice	2 C	do.
Scott, David	2 C	Dundee.
Scott, Richard	1 C	N Shlds.
Sheret, James	2 C	do.
Trelawney, Wm.	2 C	London.
Thompson, T. B.	2 C	N Shlds.
Warren, F. W.	2 C	Sthmptn.
Weddell, N.	1 C	N Shlds.
Whitehead, W.	2 C	Lvrpool.
Whitburn, H. L.	1 C	Plymouth.
Worton, Harry	2 C	N Shlds.
Wright, Peter	1 C	do.

ROBERT JACKSON, Registrar-General.
General Register and Record Office of Shipping and Seamen
32, Basinghall Street, London, E.C.

IN our last issue we reproduced a paragraph from the *Gazette* with reference to the new material invented by Dr. Dennys for coating the bottoms of ships, and it is encouraging to steam and iron shipowners to be able to state that the trials which have so far been made have proved highly satisfactory. The Straits steamer *Japan*, upon which a patch of the paint was applied some six months ago, has gone into dock, and the result proved eminently satisfactory to the dock authorities, the owners, and all who went to examine it, the portion so painted being almost clean, while the rest of the hull below the water line was foul with barnacles and other excrescences. The *Benmore*, of the same line, has just received a complete coating, while other vessels have been partially coated to give the paint a trial. Some other steamers which were experimented upon about the same time as the *Japan* will shortly be docked, when the resisting properties of the paint will have been fairly determined. We believe that this is not the result of a sudden finding, but the fruits of many years' work, and great credit is due to the energy and perseverance which have been shown by Dr. Dennys in an enterprise which we trust may prove as remunerative to the inventor as the present results seem to prove it to be useful to all steamship owners. We should add that plates coated without priming and submerged for six and a half months show no trace of any action of the iron. We understand that nearly all the shares of the proposed company have been privately bespoken, and that steps will at once be taken to put matters in train.—*China Express*.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, DECEMBER 1, 1881.

EDITORIAL NOTES.

THE horrible disaster on the Solway Steamship only serves to point out more forcibly a firm conviction in our mind that all so-called accidents are referable to culpable negligence. There are two classes of people who are mainly responsible for all accidents, those who are indolent and those who are selfish. Though these failings are not, generally considered, very culpable or criminal, they are frequently as much the cause of great disasters, loss, and death to innocent people at large, as are the recognized evils of malice, hatred, thieving, or robbery. Nothing can excuse the carrying of a cask of inflammable oil or spirit on the deck of a ship, and more particularly on the deck of a steamer carrying passengers. No doubt it is often done without any consequent disaster, and, in this case, no harm was thought likely to come of it. That is how ninety-nine out of a hundred accidents are caused by those who are too indolent to think of probabilities and to provide against them, or by those who are too dishonestly selfish to take the trouble to carry out such precautions when known to be advisable. It may seem a hard thing to visit the consequences of such horrible disasters upon the stupid or selfish cause who did not think, or who having thought, did not consider it mattered; but all departure from honesty or thoroughness in work to the minutest details is grossly culpable.

THE electric light seems likely to have as large and varied an adaptation on board ship as on land. In fact, the conditions on board ship in the large engine power always running are exceptionally favourable to the cheap and easy production of the electric light. One of the chief drawbacks in the arrangements hitherto employed for the production of the light whilst in night action, has been the exposed situation of the lamp itself, and of the men directing its operation for the throwing of the beam in any required direction. Some very valuable and interesting modifications have just been introduced and experimented upon on board the *Sultan*. The modifications are introduced in the apparatus for throwing a beam of electric light to detect torpedo attack, so as to bring all the chief parts and the men in charge under cover. This is most important, as probably the first efforts of night attacking torpedo boats would be to disable the electric light and kill the attendants by their machine guns. The improved apparatus consists of a long vertical tube projecting up from between decks, and which can be elongated to a sufficient height when in action. This tube acts as a conductor to the beam of light from the electric light between decks. The top of the tube is covered with a hood containing a mirror, 3 ft. in breadth and 4 ft. in height, mounted on a horizontal pivot, so that the mirror can be adjusted at any angle of depression and elevation by gearing from below, as the hood can also be rotated round the tube, carrying the mirror with it. It is evident that the beam can be thus directed to any spot it is required to illuminate.

THE engine-room artificers are being brought into considerable prominence in the new arrangements of the engineer service in Her Majesty's Navy. Increased responsibilities are being thrown upon them, and consequently higher requirements. To obtain such men, however, who are always able to command high wages on shore, special inducements must be offered. We see that this is now being done in the matter of counting time towards increased pay. The engine-room artificers are also to be considered as qualified to take charge of the engines in place of an engineer officer when required, and, whilst in that position, is to get the allowances of the latter. The artificers are only to become qualified for such promotion after certain term of service, and after having obtained a certificate of competency to take charge of the engines. The preference for promotion to such responsible duties will thus always fall to those who are qualified by time and a certificate for the post. The holding of such post, we understand, to be only temporary during emergency, as the object of the present re-organization is to relieve the engineer officers of the mere mechanical drudgery of their office, and thus more clearly to establish them as gentlemen on a social equality with their brother officers of the other branch of the service.

In spite of anti-corrosive paints and protections, the hulls of our Indian troop-ships are found to be very much the worse for wear. So much so, that something like a panic as to their condition has set in amongst the dockyard authorities. These vessels were launched in 1866, and have lately been extensively repaired as to their decks, cabins, and above-water fittings. As, however, some anxiety has lately been felt at head-quarters as to the condition of their hulls under the water line, the *Euphrates* has been laid up and almost entirely gutted at Portsmouth. The result of the survey has shown that the work was not done a moment too soon, and, as a consequence, the *Serapis*, *Jumna*, and *Crocodile* are to be similarly laid up early in the spring, and the *Malabar* in the autumn. As this additional work will throw much strain upon Portsmouth dock yard, and the troop-ships will monopolize most of the long summer days, it appears that the other squadrons will come very short for repairs, and the need must be grave indeed to require such a monopoly of attention.

It is sad to realize, from the letter of Mr. Andrews to a daily contemporary, that there can be so much ignorant or malicious carelessness amongst sailors of any description in the matter of submarine cables. Such cables are an inestimable boon to all civilized nations, and would not imagine that there can be any sailor afloat who is not aware of the existence of such cables, and who does not know their value and feel the respect that is their due. And yet we find, from Mr. Andrew's statements, that cables are frequently broken by ships carelessly dragging their anchors across the line of the cable, or anchoring over it, although they are laid down conspicuously on their charts. Again, trawlers, when they have fouled the cable with their nets and brought it to the surface, do not even take the trouble to release it and lower it again, but have the ruthless barbarism to cut the cable as the easiest mode of release. In the case also of repairs being carried out at sea, the cable ships are necessarily fixtures, for the time being, to the cable at the point of splicing, and notice is put up conspicuously to that effect. And yet ships and fishing boats bear down upon these repairing vessels in apparently the most malicious way, obliging the telegraph vessel to cut adrift, and undo the work of hours or perhaps days. It is difficult to realize also what particularly animosity can be aroused by the buoys which are laid out by the telegraph people to mark positions of repair, or carrying the cable end during repair, and yet these inoffensive buoys are so frequently destroyed as to imply more than mere carelessness. These indefensible aggressions upon public convenience will probably, sooner or later, produce special legislation against them, but the best protection lies in the gradual but sure progress of knowledge and good feeling between nations, which we hope to see rapidly increase in our own generation.

THE ROTH PATENT SEA SAFE.

On Thursday, at the Royal Albert Dock, North Woolwich, there was an exhibition of Mr. A. D. Roth's patent for ensuring the safety of mails, specie, jewellery, and other valuables, in case of wreck, fire, or accident at sea. It presents the appearance of a pear-shaped buoy, strongly constructed of steel having a considerable amount of elasticity, which would be of advantage in case of its dashing against a hard substance. It is about seven feet high, and five feet across its widest part, and has two or three compartments, each of which is strongly secured inside the buoy. On the top is an automatic bell, which, with the luminous paint the "safe" is coated with, would make its position known by day or night. The safe, being made in various sizes, could be carried by any vessel either on deck or below, and, in case of accident, could be immediately set free, thus relieving the captain and officers of anxiety with regard to the valuables on board. The specimen safe shown on Thursday was surmounted by a bright nickel silver globe, which it was at first thought would help very materially to make the apparatus visible when floating about in the sea in bright weather; but the opinion was expressed that luminous paint would better answer the purpose. In addition to the security of property, the safe would act as a life-buoy, being fitted with hanging life ropes. It having a displacement of several tons, the safe would support a considerable number of people until rescued by the ship's boats or passing vessels. Mr. Roth was present to give explanations, and the weather being somewhat rough, the "riding" qualities of the safe were tested somewhat better than they would otherwise have been, though, of course, very far short of what would happen in the event of a wreck. Mr. Roth was much complimented upon his invention, which Captain Walker (late of the *Great Eastern*) has suggested would be of value, not only in saving life and property at sea, but in landing mails or despatches at any such places as the West Coast of Africa. The invention is certainly worthy of the attention of shipowners and underwriters.

AN ACCOUNT OF EXPERIMENTS MADE BY A BOARD OF UNITED STATES NAVAL ENGINEERS WITH SCREW PROPELLERS OF DIFFERENT MATERIAL AND DIMENSIONS APPLIED TO THE UNITED STATES FISH COMMISSION'S STEAMER "LOOKOUT" WITH THE HULL COPPERED AND NOT COPPERED.

By Chief-Engineer Isherwood, U.S. Navy.

From the Journal of the Franklin Institute.

(*Continued from page* 176.)

RESULTS.

The experiments allow the difference between the resistance of the hull when coppered and when uncoppered to be determined. The mean speed of the five experiments *A*, *B*, *C*, *D*, and *E*, with the uncoppered hull (line 2, Table No. 2) was 9·9741 geographical miles per hour; and the mean thrust of the screw, expressing the resistance of the vessel, was 1814·1283 pounds (line 4, Table No. 2). The mean speed of the two experiments, *F* and *G*, with the hull coppered, was 9·8442 geographical miles per hour, and the mean thrust of the screw was 1612·0248 pounds. The latter quantity increased in the ratio of the squares of the speeds 9·9741 and 9·8442 geographical miles per hour, becomes 1654·8370 pounds, which compared with the 1814·1283 pounds, shows that leaving off the copper from the exterior immersed surface of the hull, increased its resistance 12·5372 per centum over its resistance when coppered.

The experiments also allow the determination to be made of the power of the speed in which the resistance of the hull increased for the interval between the extreme experimental speeds of 9·5346 (experiment *A*) and 10·4190 (experiment *D*) geographical miles per hour. For this purpose, the mean of the speeds and of the corresponding resistances of the hull in experiments *A*, *C*, and *G*, in which the speed did not vary enough to sensibly influence the result, will be taken for one speed; the mean of the speeds and of the corresponding resistances of the hull in experiments *B*, *E*, and *F*, in which the speed did not vary enough to sensibly influence the result, will be taken for another speed; and the speed and resistance of the hull in experiment *D* will be taken for the last speed. The resistances of the hull, line 4, in experiments *F* and *G*, during which the hull was coppered, will be equated for those in the remaining five experiments during which the hull was uncoppered, by multiplying them by the 1·125372 in the immediately preceding paragraph.

The mean speed of experiment *A*, *C*, and *G*, was

$$\left(\frac{9{\cdot}5346+9{\cdot}6264+9{\cdot}7493}{3}=\right) 9{\cdot}6368 \text{ geographical miles per hour;}$$

and the mean corresponding resistance of the hull was

$$\left(\frac{1650{\cdot}9925+1688{\cdot}6734+\overline{1580{\cdot}2261\times 1{\cdot}125372}}{3}=\right) 1706{\cdot}0027 \text{ lbs.}$$

The mean speed of experiments *B*, *E* and *F* was

$$\left(\frac{10{\cdot}0974+10{\cdot}1929+9{\cdot}9390}{3}=\right) 10{\cdot}0764 \text{ geographical miles per}$$

hour, and the mean corresponding resistance of the hull was

$$\left(\frac{1851{\cdot}0375+1909{\cdot}3913+\overline{1643{\cdot}8234\times 1{\cdot}125372}}{3}=\right) 1870{\cdot}1139 \text{ lbs.}$$

The speed of experiment *D* was 10·4190 geographical miles per hour, and the corresponding resistance of the hull was 1970·5470 pounds.

The experiments with the closely approximating speeds have been grouped and their mean results taken, because the greater the number of observations included the nearer accurate is the final determination.

From the above it appears that the resistance of the hull for the increase of speed from 9·6368 to 10·0764 geographical miles per hour was in the ratio of the 2·0590 power of the speed. Had the resistance for the speed of 10·0764 miles been 1865·1949 pounds instead of 1870·1139 pounds, it would have increased exactly as the square of the speed; the difference of 4·9190 pounds is only 0·0026 per centum of the experimental resistance in excess.

There also appears from the above that the resistance of the hull for the increase of speed from 10·0764 to 10·4190 geographical miles per hour was in the ratio of the 1·5646 power of the speed. Had the resistance for the speed of 10·4190 miles been 1999·4435 pounds instead of 1970·5470 pounds, it would have increased exactly as the square of the speed; the difference of 28 8965 pounds is only 1·4664 per centum deficit of the experimental resistance.

Finally, there appears likewise from the above, that the resistance of the hull for the increase of speed from 9·6368 to 10·4190 geographical miles per hour was in the ratio of the 1·8472 power of the speed. Had the resistance of the speed of 10·4190 miles been 1994·1875 pounds instead of 1970·5470 pounds, it would have increased exactly as the square of the speed; the difference of 23·6405 pounds is only 1·1997 per centum in deficit of the experimental resistance.

It is obvious that the slight differences found between the experimental resistances, and what these should be according to the ratio of the squares of the speeds, are so small that they may be fairly attributed to errors of observation and assumption. In fact, the data evidently cannot be relied on as to any greater accuracy, and the conclusion is, therefore, warranted that within the experimental speeds the resistance of the hull of the *Lookout* at different speeds varied as the squares of the speeds.

In experimenting with different propellors for the purpose of ascertaining their relative economic merits, that is to say, the relative percentage which they apply to the vessel propulsively of the power they receive from the engine, care should be taken that in every experiment the same speed of vessel be maintained, which equality eliminates all question as to the law of variation of resistance of the hull in function of its speed. If that resistance increase as the squares of the speeds, then the accuracy of the results is not affected by variations of the vessel's speed because the slip of the same propeller would remain constant at all speeds, the reaction it obtains from the water varying always as the square of its revolutions in equal time. But if the resistance of the vessel increase in a higher ratio than the square of the speed, then the slip of the same propellor would be proportionally greater at higher than at lower speeds of the vessel, and the propellor experimented with at higher speed would, relatively to another experimented with at lower speed, give a less economic result than if it were experimented with at the same speed. At the higher speed there would be proportionally more power expended in the slip, and consequently more power expended in overcoming the resistance of the water to the surfaces of the propeller moving in it. In other words, at the higher speed of vessel the same propeller will apply to it propulsively a less percentage of the power received from the engine than at the lower speed, if the resistance of the vessel increase in a higher ratio than the square of its speed.

Assuming, in the case of the experiments with the screws of the *Lookout*, that the resistances of the vessel at the different speeds varied as the square of those speeds, an assumption warranted by the experimental results, the following would be the resistances of the coppered vessel for a speed of 10 geographical miles per hour, deduced from the experimental resistances at the experimental speeds in the ratio of the squares of these speeds to the squares of 10:—

Screw.	Resistance of vessel in pounds at 10 miles per hour.
A	1613·78
B	1613·24
C	1619·28
D	1613·02
E	1633·06
F	1664·06
G	1662·54
Mean,	1631·28

In the above determinations the experimental resistances with screws *A*, *B*, *C*, *D*, and *E* have been reduced in the ratio of 1·125372 to 1, as the vessel in those cases was not coppered, that ratio expressing the effect of the coppering.

An examination of line 23, Table No. 2, shows that screws *B*, *C*, *D*, and *E* had the highest economic efficiency; also, that their economic results were sensibly the same, as they all applied propulsively to the *uncoppered* vessel, 70 per centum of the net horse-power developed by that engine, that is to say, 70 per centum of the power applied to the crank-pin. And, if the proper correction be made for the diminution of the vessel's resistance due to coppering, these screws would have usefully applied to the *coppered* vessel 71·3117 per centum of the net horse-power developed by the engine. Now, screws *B*, *C*, *D*, and *E*, though having the same diameter and number of blades, varied largely in pitch and in the fraction used of the pitch, the pitches being 7·500, 7·500, 8·625, and 9 feet, and the respective fractions used of these pitches being 0·5283, 0·2703, 0·1994, 0·3549, showing that for a given diameter the pitch and fraction used of the pitch may vary considerably without affecting the economic performance of the screw. This arises from the fact that the losses of useful effect by the screw are, 1st, that which is due to its slip, and 2nd, that which is due to the resistance of the water on the surface of its blades; including, in 2nd, the direct resistance of the forward edges of the blades. And that the first loss cannot be diminished without the 2nd loss being increased, *pari passu* and *vice versa*. The slip depends on the proportion of the acting surface of the screw in a given time, relatively to the resistance of the vessel, and can only be lessened by adding more of such surface, which, with a given diameter of screw, can be effected by either diminishing the pitch or increasing the fraction used of the pitch. But, as the loss by the resistance of the water on the screw surface is in direct proportion to that surface multiplied by the square of its velocity, any increase of the acting surface is necessarily accompanied by increased loss due to this cause. The two kinds of loss are found experimentally to be so balanced in nature that, within very considerable limits, whatever can be diminished of one kind is attended by an almost exactly equivalent increase of the other kind.

Screw *G* applied to the coppered vessel, and having the same diameter as screws *B*, *C*, *D*, and *E*, with the pitch of 7·9 feet, which lies within the limits of their pitches, gave a utilization of 69·8750 per centum of the net power developed by the engine, instead of the utilization 71·3117 per centum, that would have been given by those screws had they been applied to the coppered vessel. This shows an inferiority of $\left(\frac{71{\cdot}3117 - 69{\cdot}8750 \times 100}{71{\cdot}3117} = \right)$ 2·0147 per centum for screw *G*, which is probably owing to the excessive fraction used of its pitch, namely, 0·5736, the largest fraction used in the cases of screws *B*, *C*, *D*, and *E* being 0·5283. The increased power required to overcome the resistance of the water to the surfaces of screw *G*, owing to the increased fraction used of its pitch over the largest fraction used with screws *B*, *C*, *D*, and *E*, was probably greater than the lessened power expended in the lessened slip consequent on the use of that greater fraction of the pitch.

(*To be continued.*)

ON THE PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.

By Mr. F. C. Marshall, of Newcastle-on-Tyne.

(*Continued from page* 180.)

We have now considered three of the means of increasing efficiency, but it is clear that anything that can be done with the present boiler is limited by one measure, namely, the power of the chimney. Mr. Perkins has shown us that in his boiler, with slow combustion, he can develop in his engine 106 indicated horse-power, from 600 square feet of surface, on a consumption of under 1·7 lb. per indicated horse-power, with a working pressure of 350 lb. per square inch, and weight of boiler and appurtenances—as the writer is informed—only half that of the ordinary form. But it may be doubted whether the tubes forming the furnace, and the rows immediately over the fire, would not very rapidly burn out from the expulsion of the water, under the heat of combustion of even the ordinary 20 lb. to 30 lb. of fuel per square foot of grate.

Mr. Perkins has, however, shown us in the working of his engine and boiler that cylinders can be worked at 350 lb. pressure and corresponding temperature, without oil or other lubricants than that of the steam itself; and that boilers can be worked at sea with pure water—themselves making up their own waste—and can be kept absolutely clean and free from injurious deposit. These are important gains to our knowledge, and may no doubt bear results in the future.

The application of forced draught to the furnace has been several times used in marine boilers within the last decade and promises more than any other method a way to largely increased efficiency as well as reduction in weight.

For nearly fifty years the locomotive boiler has been in operation, and, under the action ot the blast pipe, has been the most powerful evaporative machine in existence for its weight. As has been already noticed, it does the same work on under one-third of the weight of the marine boiler. In the case of a vessel of 3,000 tons, with engines and boilers of 1,500 indicated horse-power, the introduction of locomotive boilers with forced draught would place at the disposal of the owner 150 tons of cargo space, representing £1,500 per annum in addition to the present earnings of such a vessel. The engine space of such a vessel is shown in Figs. 19 and 20, with both the ordinary and locomotive form of boiler for comparison.

Mr. Thornycroft has for some years used the locomotive form of boiler for his steam launches, working them under an air pressure —produced by a fan discharging into a closed stokehold—of from 1 in. to 6 in. of water as may be required. The experiments made gave an evaporation of 7·61 lb. of water, from 1 lb. of coal at 212 deg. Fahr., with 2 in. of water pressure, and 6·41 lb. with 6 in. of pressure. These results are low; but it is to be remembered that the heating surface is necessarily small, in order to save weight, and the temperature of the funnel consequently high, ranging from 1,073 deg. at the first pressure and 1,444 deg. at the 6 in. With the ordinary proportions of locomotive practice the efficiency can be made equal to the best marine boiler, when working under the water pressure usual in locomotives, say from 3 in. to 4 in., including funnel draught.

It has fallen to the lot of the writer to fit three vessels recently with boilers worked under pressure in closed stoke-holds. The result, even under unfavourable conditions, were very satisfactory. The pressure of air would be represented by 2 in. of water, and the indicated horse-power given out by the engines was 2,800, as against 1875, when working by natural draught, or exactly 50 per cent. gain in power developed.

The boilers here alluded to were those which, for distinction, we will call the "Navy boiler," shown in Figs. 10 and 11 and give, under ordinary conditions, very excellent results. But they have the disadvantage of greater length and weight than the locomotive form, which, more than any other, in the writer's opinion, promises to meet the future requirements of the marine engineer. Two objections to its use on board ship have hitherto existed: first, it is supposed they must be deficient in steam room, and therefore very liable to prime; and, secondly, there is difficulty in keeping clean, and liability to become salted up.

The first objection is entirely one of construction, and need not exist. The boiler may be made with ample steam room by the addition of a steam dome, or by making the firebox casing higher than the barrel of the boiler, so as to be of sufficient capacity, without increasing the weight of water, as shown in Figs. 19 and 20. The second objection can be met, and is now met in most services, by the increased care now taken by all engineers of their boilers, both in working, and when in port. The construction of the boiler need not be such as to make it any less accessible than the present marine boiler; and there is no reason why the water need be worse than that used for locomotives on land. As a rule it is much better, when surface condensers are attended to. The principal difficulty is the "human factor;" and it must be admitted that marine engineers are much better educated and and more intelligent now than ten years ago, and are becoming more and more so. It is also to be considered that, should their responsibility be increased, they are the more likely to become fitted for it.

Great advantages are to be gained by the introduction of another form of boiler combined with forced draught, and the locomotive form is that presenting the fewest objections.

In referring to the examples given in Table I., it was shown that saving was effected equal to that calculated by the use of higher working pressures, indicating that further progress lies in the same direction; although the saving may be fractional, and cannot possibly equal past results for the same increment of pressure. Table IV. shows:

1. The quantity of steam and coal used at pressures varying from four to eleven atmospheres, assuming the ratio of expansion to be varied so as to produce the same terminal and back pressure.
2. The same, assuming six expansions and the same back pressure.
3. The same, assuming eight expansions and the same back pressure.

The total working pressure of to-day may be accepted as 105 lb., or equal to seven atmospheres. If it were boldly accepted that eleven atmospheres, or 165 lb., were to be the standard working pressure, the result would be a gain of 14·55 per cent., provided no counteracting influence came into play. Of course, there are forces which war aginst the attainment of the full extent of this advantage, viz., the greater condensation in the cylinders and loss in the receiver or passages.

In regard to the former, it may be questioned whether by steam jacketting the high-pressure cylinder, correctly proportioning the steam passages, and giving a due amount of compression in both cylinders, this may not be reduced far below the generally received notion; and the latter cause of loss may be considerably reduced in its effect by a more carefully chosen cylinder ratio. The ratio usually adopted, between 3·5 and 4 to 1, whether the pressure be 70 lb. or 90 lb., may well be questioned in view of the results shown in the case of Nos. 6, 15, and 17 in Table I. There, with a cylinder ratio of 2·95 to 1, the economic performance is very good, and equal to any with the higher ratio; and it may be added that the cases quoted are amongst the most reliable and trustworthy of the list.

A lower cylinder ratio has another advantage of considerable value, viz., that the working pressure can be much reduced as the boilers get older, while, by giving a greater amount of steam, the power may be maintained—at an extra cost of steam, of course, but not so great a cost as with higher ratios. This fact was mentioned by Mr. Macfarlane Gray in the discussion on Sir Frederick Bramwell's paper in 1872.

The starting has usually fixed the cut-off in the high-pressure cylinder at about 0·6, and the ratio of expansion has decided the ratio of cylinders. The use of separate starting valves in both cylinders obviates that necessity. The difficulties in the way of taking advantage of the higher economic properties of greater pressures than hitherto used on board ship, are, it is submitted, not insuperable, and it would be to the interest of all that they should be firmly and determinedly met.

The quantity of steam used in the compound receiver engine and and Woolf engine respectively, are stated by Mr. D. K. Clark, in his Manual of Rules, Tables, and Data to be:—

	Per Indicated Horse-Power.
Receiver engine	18 to 20 lb.
Woolf engine	20 to 21 lb.

It is a remarkable coincidence that the long voyage results given in Table I. exactly confirm Mr. Clark's figures. It may therefore be accepted as an average result that the Woolf engine, as usually arranged, will use 10 per cent. more steam than the receiver engine for the same power. Of the three-cylinder receiver type, the data are insufficient to form a definite opinion upon; but so far the general working of the Arizona is stated to be as good, economically, as any of the two cylinder receiver class.

It is only right to mention here that the results referred to are very seriously affected by the condition of the valves and gear at the time; and still more by the setting of the valves, and the relations of the admission, port-opening, release, and compression, to the movements of the piston. The efficiency of an engine may be reduced enormously by carelessness in this matter, and when efficiency is of such vital importance, these matters of detail cannot be too strongly urged upon steamship owners. It is not too much to say that nine-tenths of the engineers in charge of engines know nothing of the condition of their valves, and it is not till serious waste or mishap occurs, that they are thought of.

The surface condenser remains as it was ten years ago, with scarcely a detail altered. In most engines it remains a portion of the framing, and as such adds greatly to the weight of the engine. It is a question seriously worth consideration whether or no the surface of tubes can be reduced. The practice at present is to make the surface one-half the boiler surface as a minimum, that is, equal to about 2 square feet per indicated horse-power. In practice, the writer has found 1·4 square foot per indicated horse-power to maintain a steady vaccum of 27½ in. The only experiments on this subject of practical and accurate character are those conducted by Mr. B. G. Nichol, of this town, an account of which appeared in *Engineering*, December 10, 1875. It was found that when the water flowed through the tubes with a velocity of 100 ft. per minute, 1 square foot was quite sufficient to transfer 527 units of heat from the vapour of the condenser to the water, for each degree Fahr. of effective difference of temperature. Now in general we only have 200 units passing through for each degree of effective difference, so that even with water passing through at the slow velocity named, there is a large margin for the dirt in the tubes frequently found in condensers. Then again, an engine using 22 lb. of steam per indicated horse-power must require more surface than one using 17 lb.; and if 2 square feet be necessary for 22 lb., while, by increasing initial pressure, the quantity of steam can be reduced to 16 lb. per indicated horse-power, we should only require 1·45 square foot per indicated horse-power, to give the same vacuum, if the condensing water remained the same.

The method generally in use, of passing water through the tubes, is much more efficacious than exhausting through, as is sometimes done in Her Majesty's Navy. The circulation is never so perfect in the latter case, and much more water is carried. The ordinary plan gives more control over the quantity, and also better circulation of the water.

The air and circulating pumps, for engines of 1500 indicated horse-power and under, are, as a rule, worked entirely by levers attached to the low-pressure connecting-rod crosshead. They thus help to balance the piston and rods of that engine. The circulating pump is made single or double acting; the single acting has the advantage of adding to the balancing of the weights, and offers no obstruction to the flow of water; the double acting has the effect of checking the column at each stroke, and is not so easy in working.

The Gwynne centrifugal pump is extensively used for circulating and bilge purposes, and is a very valuable auxiliary to the main engine.

The extended use of steel offers great advantages for the reducing of weights, and especially in the form of hollow shafts, such as are now being manufactured by Sir Joseph Whitworth & Co. On this system, in a 10-in. shaft, a hole is run 4 in. in diameter, reducing the weight 16 per cent., while its strength is only reduced 2·56 per cent.; or, if the hole were increased to 5 in. the weight would be reduced 25 per cent. and the strength only 4·25 per cent.; and it is a question whether the weight could not be further reduced by giving a lower nominal margin of safety, which it would seem might be done on account of the greater elasticity of form, as well as elasticity and homogeneity of material. The surface presented by a steel shaft to the bearings is also—it is not too much to say—almost infinitely more perfect than the forged iron shaft with its reeds, open texture, and iron cinder, from which marine engineers suffer so much. The friction must therefore be greatly reduced.

The writer has just completed six pair of engines for three twin-screw ships, having steel shafts of 10 in. diameter, and has in each case run the engines at 120 revolutions per minute, while indicating 1380 horse-power from each pair, for ten to fifteen hours without stopping; and in no case has a single bearing or crank-pin warmed or had water applied, the surfaces on examination being perfect.

In these engines all working bolts, pins, and rods, except the piston and connecting-rods, are of steel, all rods in tension being loaded to 8000 lb. per square inch. The boilers are of the Navy type, made throughout of Siemens-Martin steel plates, rivetted with steel rivets, all holes drilled. Furnaces are welded and flanged; the tubes are of brass. In comparison with an ordinary merchant steamer's iron boilers of the double-ended type, they weigh, including water and all appurtenances, as follows:—

	Double-ended Type.	Navy Type.
Weight, tons	135	146
Indicated horse-power... ...	1400	2760
Draught...	Natural	Forced.

The use of steel castings is becoming considerable; they give great strength, but unfortunately the still persistent presence of blow-holes prevents their strength, and their wearing to a polished surface, being relied on to the extent that could be wished.

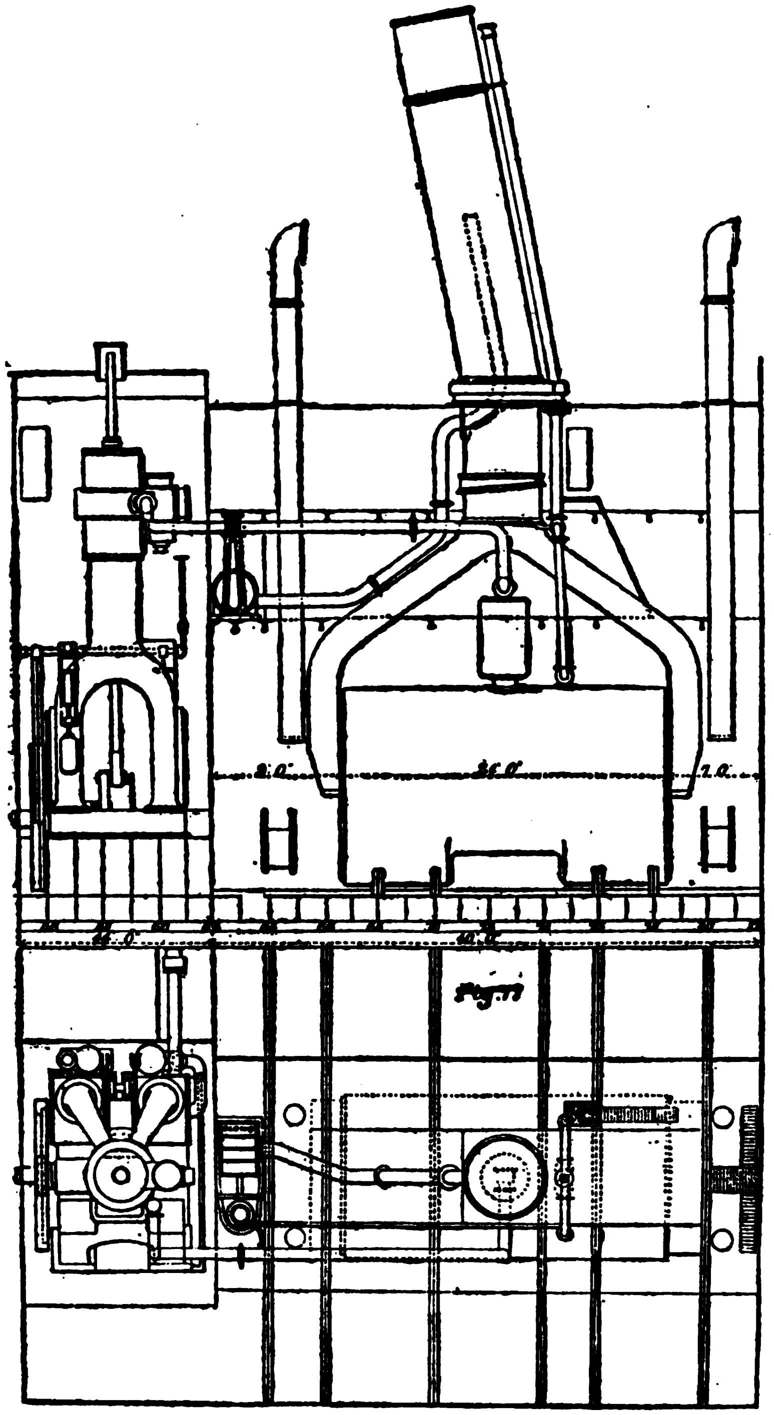
For our large steamers steel-built crankshafts must come more and more into use. The constant failure of iron cranks, even when built up, is too serious a question for the shipowner to let alone long. It is important to note Mr. Holt's remarks on his return to the old-fashioned mill-engine form of crank. The single bearing of great length on the end of a long length of screw shafting—the crank-pin with small surface velocity, the simple crank, made, as it can now be made, to be practically solid with the shaft—are all great steps in the way of simplicity; provided only shipowners care to adopt the single engine, which, even if 10 per cent. more costly in fuel, has much to commend it.

The cast-steel propeller blades introduced by Messrs. Vickers, are being more largely used; the reduction in thickness enables them to be much more easily driven.

The screw propeller is still to a great extent an unsolved problem. We have no definite rule by which we can fix the most important factor of the whole, namely, the diameter. Mr. Froude has pointed out that by reducing the diameter, and thus the peripheral friction, we can increase the efficiency; and this is confirmed by cases—of Iris reduced 2 ft. 3 in., and the Arizona

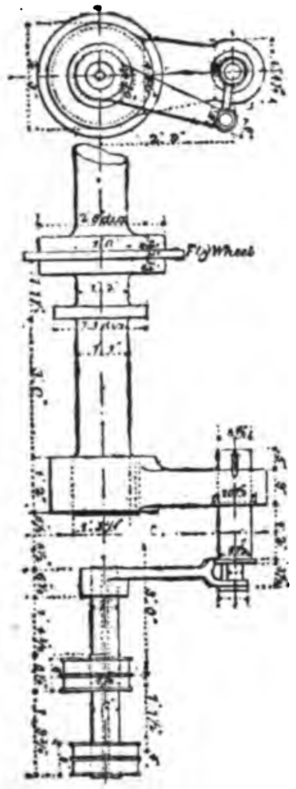
FIG. 16.

FIG. 17.



ARRANGEMENT OF MARINE ENGINES AND BOILERS.

(See F. C. Marshall's Paper " On the Progress and Development of the Marine Engine.")


Fly Wheel
2' 9"
3' 6"
3' 0"
1' 1½"

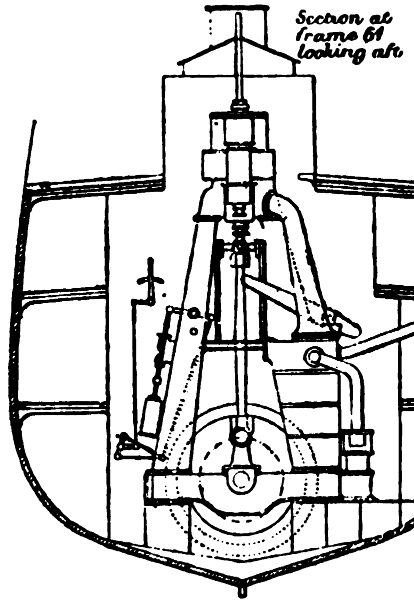

Section at frame 61 looking aft

FIG. 18.

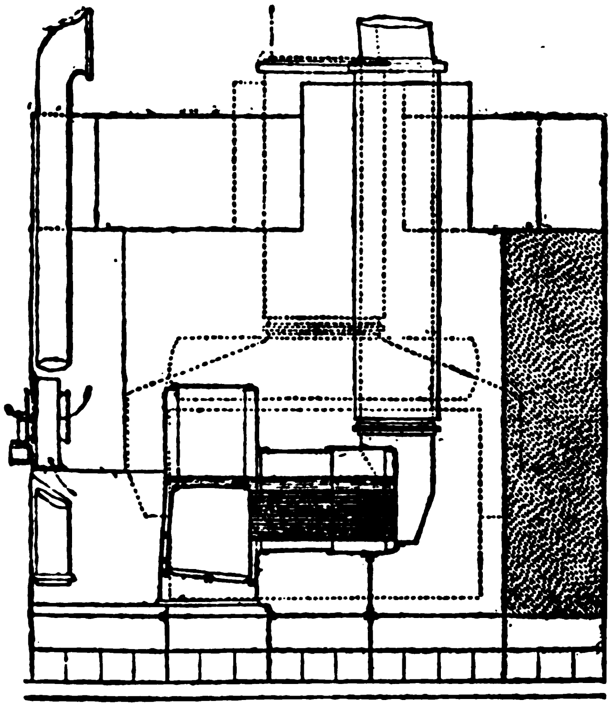


FIG. 19.

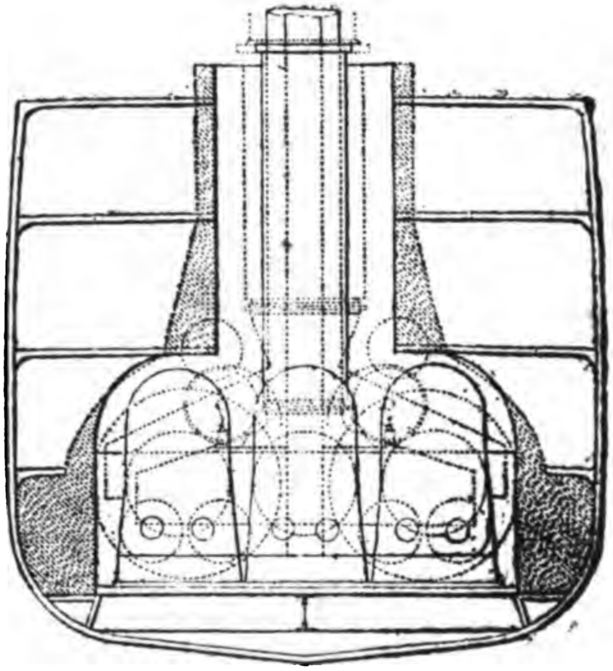


FIG. 20.

ARRANGEMENT OF MARINE ENGINES AND BOILERS.

(See F. C. Marshall's Paper " On the Progress and Development of the Marine Engine.")

TABLE IV.—Quantity of Steam and Coal used per I.H.P. for various Working Pressures.

1.—*The same Terminal and Back Pressure assumed throughout.*

Total working pressure, lb. per square inch ...	60	75	90	105	120	135	150	165
Number of expansions...	4·57	5·72	6·86	8·00	9·15	10·28	11·42	12·00
Steam used per indicated horse power per hour, lb.	21·93	19·13	18·44	17·22	16·4	15·65	15·0	14·53
Net coal per " " "	1·8	1·58	1·52	1·43	1·36	1·30	1·25	1·224
Ratio of net coal, that for 105 lb. being unity ...	1·26	1·104	1·061	1·000	0·95	0·91	0·875	0·8545
" " 60 " " ...	1·000	0·8775	0·842	0·794	0·755	0·7225	0·695	0·6786

2.—*Six Expansions and the same Back Pressure assumed throughout.*

Total working pressure, lb. per square inch... ...	60	75	90	105	120	135	150	165
Steam used per indicated horse power per hour, lb.	19·09	18·88	18·45	18·1	17·81	17·6	17·42	17·2
Net coal " " "	1·569	1·556	1·528	1·502	1·483	1·469	1·458	1·442
Ratio of net coal, that for 105 lb. being unity ...	1·043	1·035	1·016	1·000	0·988	0·977	0·97	0·959
" " 60 " " ...	1·000	0·9925	0·964	0·96	0·945	0·935	0·929	0·918

3.—*Assuming Eight Expansions and the same Back Pressure.*

Total working pressure, lb. per square inch... ...	60	75	90	105	120	135	150	165
Steam used per indicated horse power per hour, lb.	18·8	18·1	17·64	17·21	17	16·65	16·5	16·39
Net coal " " "	1·544	1·491	1·459	1·429	1 415	1·388	1·38	1·373
Ratio of net coal, that for 105 lb. being unity ...	1·053	1·043	1·021	1·	0·991	0·972	0·966	0·962
" " 60 " " ...	1	0·966	0·945	0·925	0·917	0·897	0·894	0·89

reduced 2 ft. This must of course be qualified by other considerations. The ship has by her form a definite resistance, and a certain speed is required; if the propeller be made too small in diameter, the ship will not be driven at the required speed, except at serious loss in other directions.

This question is too large and complicated to be dealt with here, and should, in the first instance, be made the subject of careful and extended experiment, on which a separate paper should be written. The writer's object is to point out the important bearing this question has upon the marine engine. We have shown the importance of the reduction of weight to the shipowner; the smaller the propeller the smaller the engine needs to be to drive it, and therefore the less the weight to be carried; but to produce the same result in driving the ship the propeller will need to be turned faster, and the faster it can be turned, consistent with efficiency and small wear and tear, the better. That we are a long way within our powers, in our ordinary practice, in this latter respect, is proved by the engines of torpedo vessels developing 470 indicated horse-power at 443 revolutions and 886 ft. piston speed per minute; the Iris developing 3857 indicated horse-power at 99 revolutions and 582 ft. of a 75 in. piston per minute; and the engines recently constructed, before alluded to, giving out 1400 indicated horse-power at 124 revolutions, and 724 ft. per minute of a 60 in. piston. To do this, however, the working parts must be carefully balanced, a matter very much neglected, and one which leads to great wear and tear in shafts, crank-pins, &c. Such effects, not being considered sufficiently in the first instance, are urged against the adoption of higher velocities, not specially in the piston, but what is far more important, in the speed of revolution, which, as experience is showing us, may be vastly increased to the advantage of all, and specially of the shipowner, whose interests it is the first interest of our profession to promote.

To sum up the whole. Progress has been made during the past nine years, and in the following particulars:—

1. The power of the engines made and making show a great increase.

2. Speeds hitherto unattainable are now seen to be possible in vessels of all the various classes.

3. The consumption of fuel is reduced by 13·38 per cent. on the average; and numbers of vessels are now working on much less coal than that average, while the quality of the coal is in nearly all cases very inferior, so that it is not unfair to take credit for 20 per cent. reduction.

4. The working pressures of steam are much increased on the average, and are still increasing; many steamers now being built for 120 lb. per square inch, while 90 lb. is the standard pressure now required.

As increased pressure means increased efficiency, there does not appear any reason why the standard of 150 lb. should not be sought as that of the future; combined with the adoption of the locomotive description of boiler and forced draught. Higher speeds of revolution appear to be desirable, with a view to very great reductions in weight of machinery carried. This implies careful balancing and adjustment of all working parts, as well as of the steam, to the work to be done.

The more general introduction of steel in all its varieties is enabling the marine engineer to adopt means tending throughout to lighten working parts, and to increase velocities, in a way he dared not attempt nine years ago.

In conclusion the writer begs to submit this paper to the Institution as a very imperfect *résumé* of the progress and development of the marine engine, and only as a sequel to that of his distinguished predecessor. His time has not permitted him to go fully into the many questions arising out of the subject, and he asks that it may be received only as a basis of discussion by the Institution, many members of which are much better able to deal with it than he feels himself to be.

The writer desires to tender his warmest thanks and acknowledgments to the numerous shipowners, manufacturing engineers' marine superintendents, and others, who have so freely supplied him with valuable information for this paper, some at considerable expense and trouble.

He has also pleasure in acknowledging the careful assistance rendered by Mr. A. Blechynden, M.I.M.E., in the preparation of the details and calculations of the paper.

ERRATUM.

"Page 155, Perkins boiler (see Illustration next No.)" should read "see Illustrations pages 255 and 256, Vol. 2." Illustration page 176, Fig. 12, should read 13, and page 178 Fig. 13, should read 14.

A BOAT destined to be propelled solely by electricity has just been completed, according to the French journal *Lumière Electrique*, The owner, M. Tellier, intends to launch it at Boulogne and to cross in it to Folkestone, in company with a friend. The boat is decked, and is about 18 ft. long by about 4½ ft. wide.

LIGHTFOOT'S DRY-AIR REFRIGERATOR.

WE understand that Mr. T. H. Lightfoot, of 116, Fenchurch-street, E.C., has made arrangements with the well-known firm of engineers, Messrs. Douglas & Grant, of Kirkcaldy, N.B., for the manufacture of his patent dry-air refrigerator. This machine, which was illustrated and described in our issue for October last, is now being constructed in various sizes, so as to be made applicable, not only for meat preserving on a large scale, but also for innumerable purposes in the manufactures, where a reliable and cheap cooling power is calculated to be of great utility. A special form is also being constructed for preserving ships' provisions, and the time is perhaps not far distant when the carrying of live stock on board of our large passenger boats will be superseded by fresh dead meat preserved by means of a dry air refrigerator, which would also be available for making the daily supply of ice required for table use.

ANTI-FOULING COMPOSITIONS FOR SHIPS' BOTTOMS.

IN pursuance of our desire to bring under the notice of our readers the most prominent and effectual anti-fouling compositions for iron ships, we have much pleasure in giving publicity to the following interesting facts relative to Gay's marine paints, which are fast coming to the fore on account of their never-failing properties for the prevention of corrosion and fouling, however long the voyage, or in whatever part of the globe.

In the preparation of the priming coats great care is taken that they shall be entirely anti-corrosive, and of such a character that the iron has an affinity for them, and they are consequently very readily absorbed, filling up the pores of the iron, to the exclusion of any corrosive influence from air or water.

The finishing, or anti-fouling, coating is so compounded that it does not dry hard, but is of an exfoliating character, which was so strongly advocated by some of our practical correspondents in previous numbers. It will be seen from a perusal of the following that the requirements mentioned by our correspondents as being essential for a good anti-fouling composition are fully borne out in Gay's Marine Compositions.

The proper protection for an iron ship against fouling is a coating having a constantly clean and self-freeing surface. Such a surface is essential, from the known fact that in parasitic life the young only are possessed of locomotion. Hence the adhesion of living organisms takes place during the earliest condition of fry, and therefore so long as there is any permanent surface for these minute pests to hold on to for their future growth and development, so long will some of the myriads which swarm in the sea be at hand ready to take advantage of any unprotected spot on the ship's bottom.

The same may be said of the minute spores of sea-weeds, and these can never detach themselves.

Such organisms and sea-weeds do not derive the slightest nourishment from the substance to which they adhere. Barnacles and sea-weeds are simply adherent, and whilst it is a very well-known fact that no nutriment is absorbed by either living shelled parasites or by vegetable algæ from the objects to which they are attached, it is very doubtful how far any noxious qualities of the material is injurious to young fry when they first settle upon it. Still more remote is the possibility of injury from such a source to either weeds or parasites when they have attained any considerable advance in age.

For this reason alone it will be seen that the most effectual antidote to the settlement or development of any vegetable or animal growths upon the hull of a ship is the maintenance of a *perpetually clean and renewed surface*, such as would be presented under the condition of a continuous dissolution or flaking, by which the molecules of the substance to which the organisms attach themselves should be quickly liberated from the mass of the protective coating and fall away from the ship's bottom.

Nothing, probably, can prevent the adhesion of parasites, vegetable or animal, on a permanent surface. Once attached, their rapid development takes place, until such is the obstruction to the speed of the ship when her bottom has become fouled, that a diminution of from one to three knots per hour is often the result.

Such retardation of speed is a most serious and reprehensible waste of money in the extra expenditure incurred for coal, wages, probable loss of good markets, and the necessity for frequent docking, outside the important question of the absolute corrosion and waste of the ships themselves. The loss alone for extra coal, under such circumstances, say for a ship of 1000 nominal horse-power, may be represented at something very considerable.

Upon an intimate knowledge of the foregoing facts, Gay's Anti-Fouling Composition was founded many years ago, and, notwithstanding attempts have been made from time to time to pirate it, its compound is still a secret only known to the manufacturer, and it stands pre-eminent for its practical and satisfactory results, as would appear from the numerous excellent testimonials we have read from practical mariners and others who have used it on their ships.

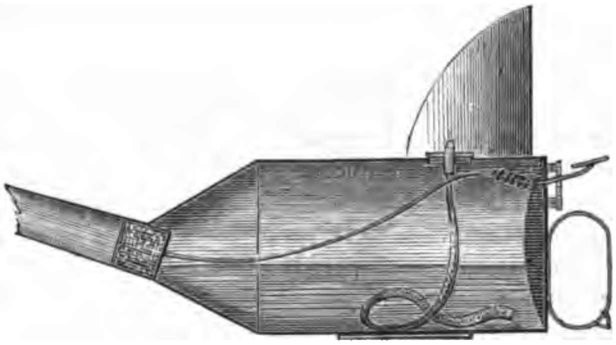
A remarkable instance of the value and durability of this composition is given by the captain of a ship—*The Winefred*—who testifies to a coating of it having been applied to the bottom of the ship, which went a voyage to Australia and the East Indies and back to Australia, and as it was found that she maintained her speed throughout, it was not considered necessary to re-dock her for two years, when she was examined. After that period, she was found to be entirely free from rust and fouling, and her bottom was well preserved.

These compositions are applied in the ordinary manner. No deleterious effects are experienced in their application. They cover well and dry quickly.

Messrs. Brown, Stevenson, & Co., of No. 11, Queen Victoria-street, City of London, and their appointed Agents are the sole vendors of these justly celebrated compositions.

GROOM'S ILLUMINATING OIL-FEEDER.

IT is a well-known fact amongst those who are acquainted with machinery and the oiling of it that more oil is wasted from oil-feeders than is actually put on the bearings at all. This arises very often from the difficulty of seeing where the spout of the oil-can is applied in intricate machinery, and the only way to make sure of some oil reaching the bearing is to pour a large quantity indiscriminatingly over the cap of journal, or, at least, in the neighbourhood of the bearing. Even when this is done, the engineer or attendant cannot be sure that the oil has really entered down the proper channels.



Groom's illuminating oil-can, illustrated herewith, is a very simple but useful invention, to enable the engineer or attendant to see what he is doing. A wick is placed in the can and brought through a burner situated on the top of the can. A reflector is also fixed partially around the light, so as to throw the illumination exactly on the point where the spout of the feeder is being directed. Absolute accuracy can thus be used in supplying the oil, and the light on the can prevents the necessity for any other lamp when oiling in the dark portions of the engine-room or anywhere in the hold. If the light is not required it need not be used, but the advantage of having a light inseparably connected to the feeder, and just throwing the light where required, should render this feeder invaluable to sea-going engineers.

DONOVAN'S BOAT-LOWERING APPARATUS.

THE apparatus hitherto so generally used for lowering out boats is now universally accepted as being antiquated and far from fit for the purpose to which it is applied. The shocking loss of life in the case of collisions or the sudden foundering of iron vessels shows plainly that the time now elapsing between piercing of the hull and the sinking of iron vessels is so short that the utmost care should be taken, and no expense grudged by ship owners to render the lowering of the boats as prompt and secure as possible.

In the matter of the fixing of the boats on chocks inboard when not in use, much valuable time is often lost in casting loose the lashings. How can such lashings be dispensed with, as otherwise the boats may easily be carried away or stove in by heavy seas?

Captain Donovan, a North-country seaman of great experience, has invented a very simple apparatus that seems fully to meet the requirements that we have pointed out, and to render the lowering of the boats an easy, safe, and expeditious operation on the most sudden emergency.

When the boats are not in immediate use they are carried inboard on special chocks, which form part of Captain Donovan's apparatus. The outside chock is movable on a pin or hinge, where it springs from the main standard. A quadrant, *a*, Fig. 1, is also attached to this chock and passes through a slot in the main standard. It is secured in each standard by a pin, or catch, which are operated simultaneously by the rod, *b*.

The lashings also are secured by links, through which a pair of bolts on the deck are run. These bolts are connected by arms and a link, *d*, so that they must be released simultaneously. As the outside chocks fall, and the lashings are released, the boat is free to swing outwards, and thus at once hang from the davit-tackle ready for lowering. The crew should seat themselves whilst the boat was still on the chocks.

The lowering away is now performed from the boat itself by a man stationed at either end, the fall-tackle

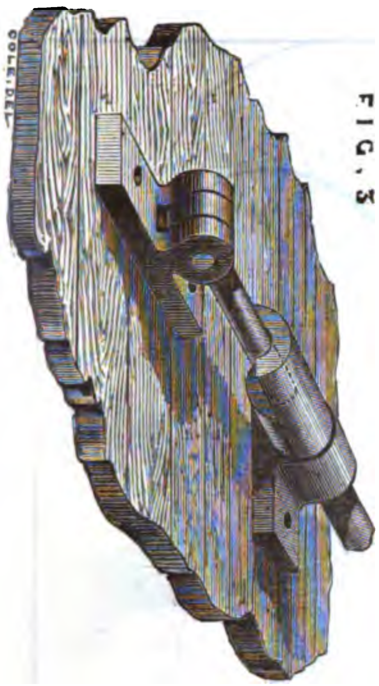


FIG. 3

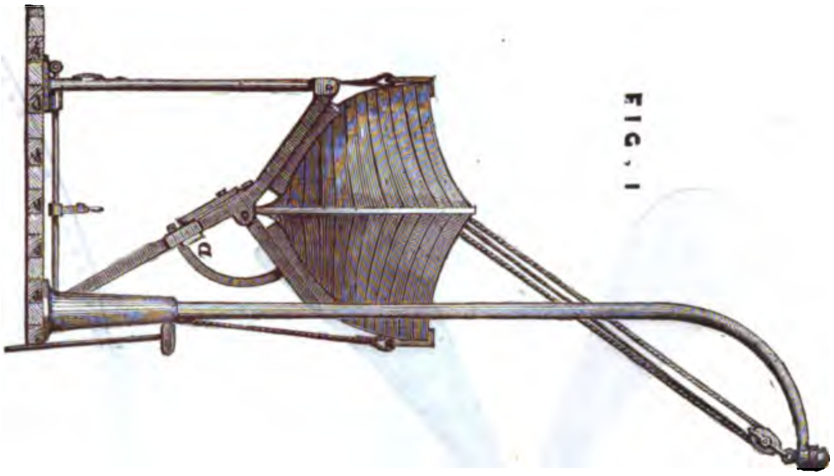


FIG. 1

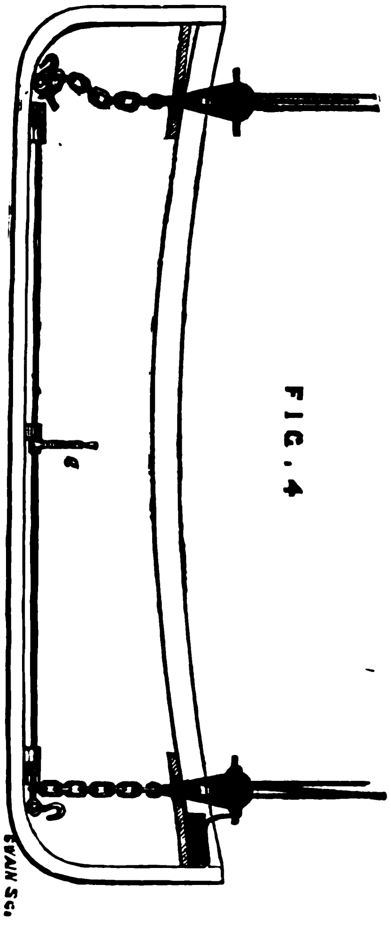


FIG. 4

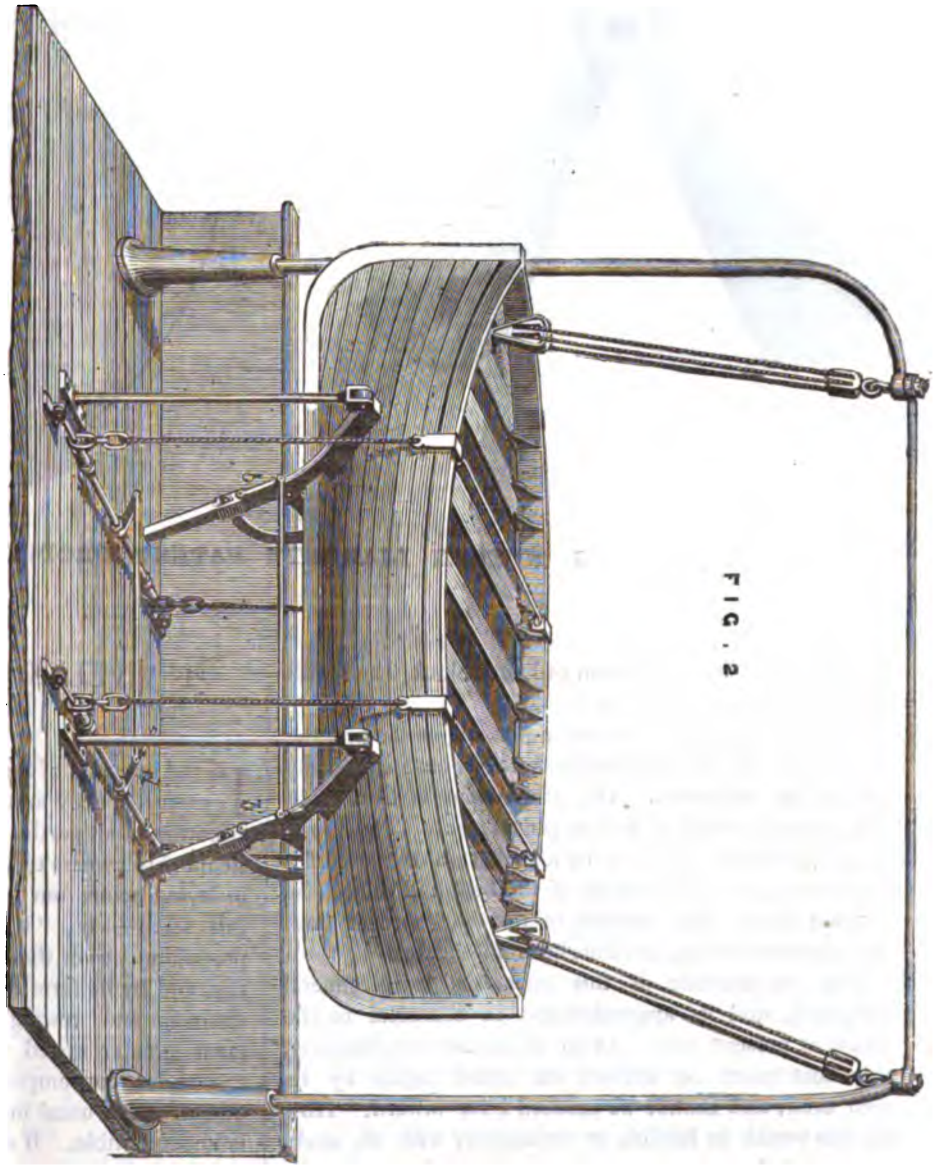
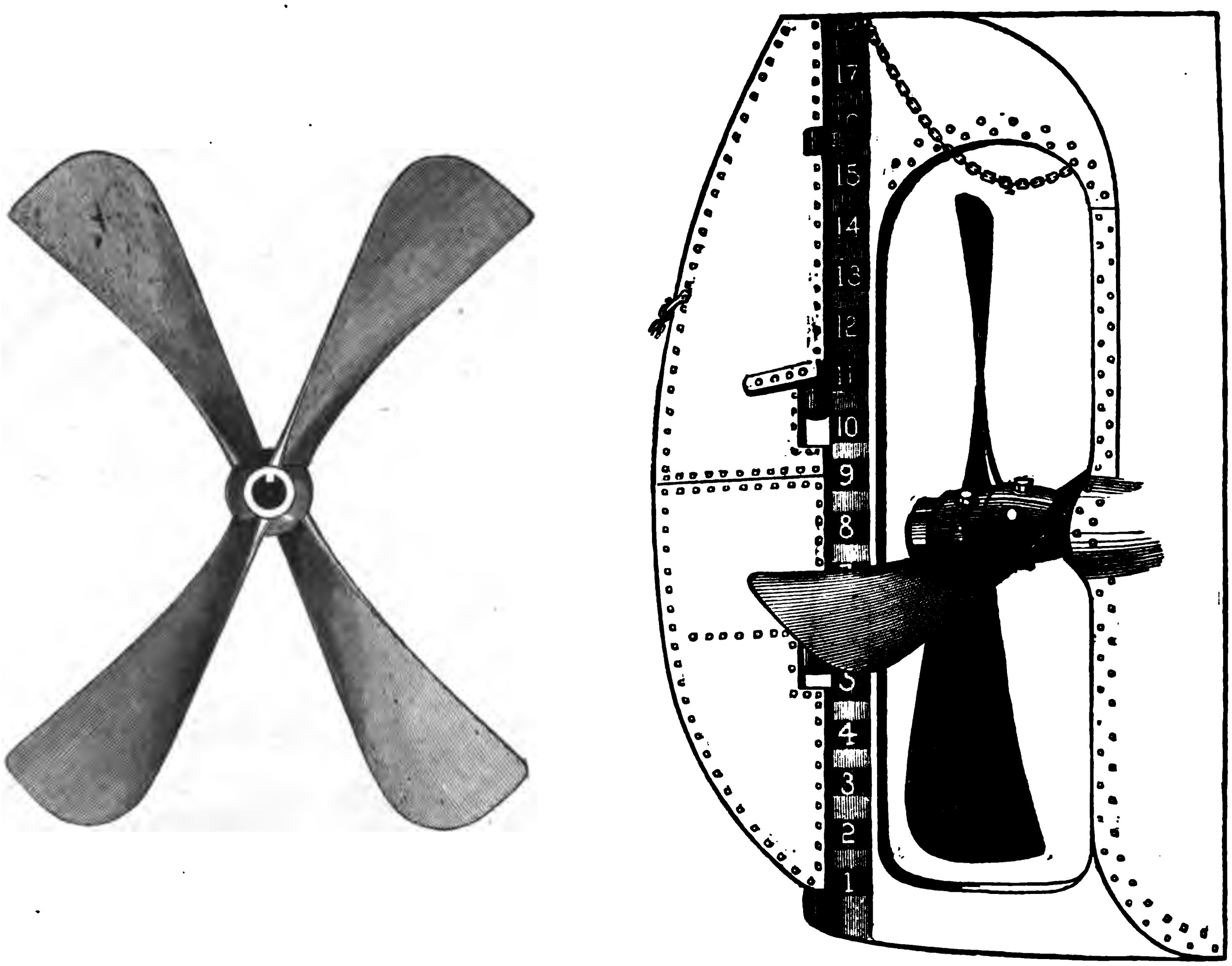


FIG. 2

DONOVAN'S BOAT-LOWERING APPARATUS.



J. EVELYN LIARDET'S PATENT PROPELLER.

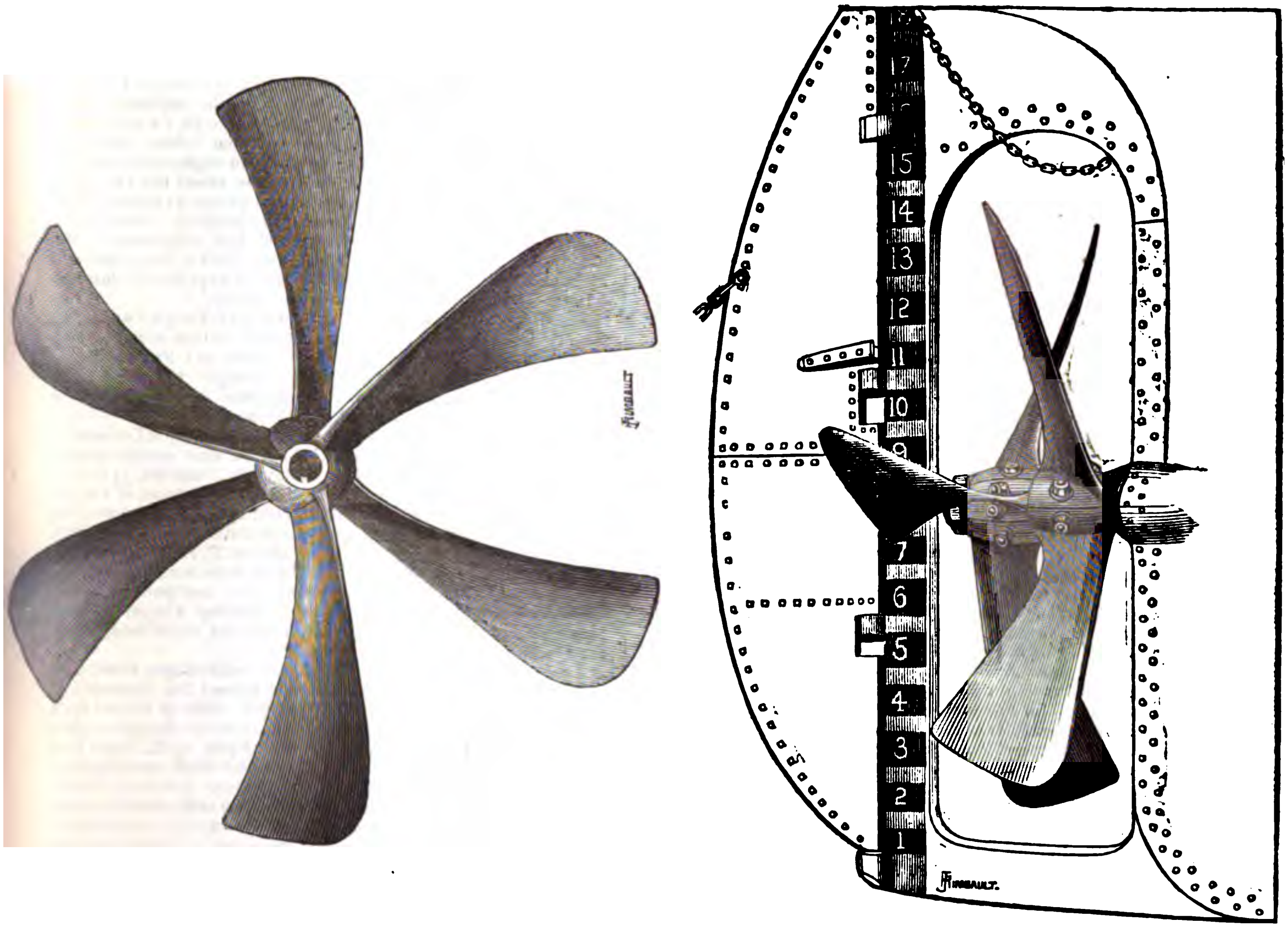
being lowered away from an ordinary block fitted with belay pins at the bottom of the falls.

When the boat reaches the water, or just before, the attachment of the fall-blocks can be instantaneously released at both ends. The attachment is by a chain link, through which a bolt or pin is shot. The pin is hinged, but held in place by a socket on the end of a bar running the whole length of the boat and rotated by a hand-lever. The rotation of this bar releases both pins simultaneously, and thus both fall-tackles.

The characteristic of this apparatus is its general simplicity, and its approximation in character to the tackle at present used. As far as we can see, however, the boat must be hoisted on board again by its own crew, and cannot be assisted from inward. How far this would be feasible or satisfactory with ill, weak, or wounded passengers or crew in the boat, we can scarcely give an opinion.

J. EVELYN LIARDET'S PATENT PROPELLER.

IN the interests of Steam Navigation, Trade, and Commerce, speedy and comfortable passages, we call the attention of all parties interested, especially that of screw steam-ship owners to this propeller. We have pleasure in laying before our readers the advantages claimed for this screw—viz., "it cuts solid water, and gives more propelling power than any other in use. It gives little slip, and by its form forces off the used water, instead of churning and towing it as other propellers do. It gives greater speed with fewer revolutions, and with a smaller consumption of coal in comparison with others. The usual unpleasant and destructive vibration is imperceptible. If ship owners are willing to incur the expense of a hollow and solid shaft working together, one-half of this propeller can be worked to the right and



J. EVELYN LIARDET'S PATENT PROPELLER.

one-half to the left simultaneously, without the liability to break, and it thus fulfils all that is claimed for screws so fitted. The Patentee (Mr. Evelyn Liardet) is satisfied that such *expensive* and *complicated machinery* is *unnecessary*, and, by fitting his propeller as a fixture on the ordinary shaft, so that each blade cuts solid water, all the force that can be obtained from the ship's engines for propulsion is produced without alteration of any kind in the ship. The key way is cut in the boss, and the only expense is the propeller, at a cost not in excess of an ordinary screw." Mr. Evelyn Liardet is well-known to the Mercantile Marine, he being the Inventor and Patentee of the Double Grip Anchor and Spring, and Double Acting Windlass. We regard his description as a common sense one, and comparing it with the diagrams before us, and the models we have séen at No. 14, Fenchurch-street, we express our confidence in this propeller; we are informed that every trial of it has been a success. It may be cast in the solid metal, or with removable blades in the usual way. It possesses another important feature of handiness, one-half only being fitted and removed at a time, half the weight has to be handled in so doing.

At the next Steam Yacht Races in 1882, no doubt the best types of propellers will be fitted to the yachts, and we hope this screw will be among them as, even in the Yacht Fleet, the trials of the various screws cannot fail to have its significance.

Mr. Evelyn Liardet's screw was well tested on Monsieur Baudet's Electric Ship, at the Palace of Industrie, Paris, and answered so well that *Le Yacht* and several French papers refer to it as being well taken up in France, and it is to cross the channel, fitted to Monsieur Baudet's Electric Boat.

We shall give special attention to the Trials of Screw Propellers, and we are impressed an official Government Trial of all the best known screws would be of great service, similar to that by the United States Government, noticed in our issues since August 1st.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Peconic.—The *Peconic*, a brig-rigged iron steamship, built to the order of the Mediterranean and New York Steamship Company, of which Messrs. Phelps Brothers & Co., of Liverpool, are the managing owners, was launched on Oct. 21st from the shipbuilding yard of Messrs. Thomas Roydon & Sons, Queen's Dock, Liverpool. This vessel which is of 1,798 tons gross, has been built on the double bottom system, with water ballast tanks fore and aft. Her dimensions are:—Length, 289 ft.; breadth, 34 ft. 4 in.; depth of hold, 24 ft. 5 in. She is being fitted with engines by Messrs. Fawcett, Preston & Co., and will be supplied with steam-steering gear by Messrs. Bow, M'Lachlan, & Co., Paisley. The *Peconic* has been constructed with a view to the transit of fruit, having ventilators specially adapted to that object. The ceremony of christening was performed by Miss Phelps.

Britannia.—On Oct. 25th, the *Britannia*, a brig-rigged steamship, built to the order of Messrs. Cyprien, Fabre & Co., of Marseilles, was launched by Messrs. Thomas Royden & Sons, Queen's Dock, Liverpool. The dimensions of this vessel, which is capable of carrying a deadweight of 3,300 tons, are as follows: —Length, 337 ft.; breadth, 40 ft.; depth of hold, 27 ft. She will be fitted by Messrs. George Forrester & Co., Vauxhall Foundry, with engines of the inverted direct-acting compound surface-condensing type, having cylinders of 40 in. in diameter for high pressure, and 76 in. for low pressure, supplied with steam at 85 lbs. pressure from two circular boilers. She will likewise be supplied with Harrison's patent steam-steering gear. The *Britannia* will, in addition to cargo space, have accommodation for eighteen first-class passengers.

Stefanie.—On Oct. 25th, there was launched from the yard of Messrs. Caird & Purdie, Barrow-in-Furness, an iron screw-steamer of the following dimensions:—245 by 35 by 17. She has been built to the highest class at Lloyd's, with water-ballast fore and aft, and all the latest improvements, to the order of Messrs. Burrell & Son, for the Adria Steamship Company. She was named the *Stefanie* by Miss Elizabeth Burrell, eldest daughter of the manging owner.

Akaroa.—On October 25th, Messrs. Osbourne, Graham & Co. launched from their shipbuilding yard at Hylton an iron sailing vessel named the *Akaroa*, built to the order of Messrs. Shaw, Savill & Co., of London, for their Australian and New Zealand trade. The dimensions of the vessel are 220 ft. by 36½ ft. beam, and 22½ ft. depth of hold, and she will register about 1,300 tons. The vessel has a full poop, containing the accommodation for the captain, officers, and a few first-class passengers; a commodious teak-house, amidships for the crew, and an open topgallont forecastle. She will be rigged as a barque, and furnished with a complete East India outfit.

Senora Cue.—On Oct. 26th, a screw-steamer was launched from the yard of Messrs, Hodgson & Sons, Cowpen Quay, Blyth. The vessel, which will be fitted with all the latest improvements, is of the following dimensions:—Length, 220 ft.; breadth, 30 ft.; depth of hold, 18 ft. 6 in. The steamer's carrying capacity is estimated at 1,400 tons, and she is classed 100 A 1 at Lloyd's. She is intended for the Spanish coasting trade, to carry first and second-class passengers, and will be fitted with engines of 130 horse-power, by the well-known firm of Messrs. Black, Hawthorn, & Co., of Gateshead. The ceremony of naming her was performed by the wife of Senor Cue, inspector to the company (Hispano Francisco), for whom the vessel has been built, who stepped forward and wished success to the *Senora Cue.*

Ganges.—On October 26th, the Peninsular and Oriental Steam Navigation Company's new steamer *Ganges* waslaunched at Barrow-in-Furness. The *Ganges*, which is built of steel, is 4,100 tons gross register, and will have engines of about 5,000-horse-power indicated. She is 390 ft. long, has 42 ft. beam, and is 35 ft. deep, and will carry 3,000 tons of cargo. The *Sutlej*, a sister ship to the *Ganges*, will be launched shortly, and both vessels will be utilized for the India, China, and Australian mail services.

Grafton.—On November 5th, the launch of the screw-steamer *Grafton*, built to the order of the Grafton Steam Shipping Company, London (Managers, Messrs. E. W. Morgan and Co.), took place at the Shipyard of Messrs. Robert Thompson & Sons, Southwick, Sunderland. She is of the following dimensions, viz.:—Length, 270 ft.; breadth, 36½ ft.; depth, 24½ ft. She has been built on the spar deck rule, under the special survey of Lloyd's to class 100 A1. She has water ballast on the improved cellular bottom principle, and has a large smokehouse aft for convenience of captain and officers, and a spacious cabin below. Engineers are accommodated under spar deck next to engine-room, and crew in forecastle under the spar deck. The vessel has four steam winches and donkey boiler, large patent gangways abreast of each hatch (four in number) for speedy discharging. Schooner rig, double topsails, and all the latest and best improvements, and engines of 180-horse power, by George Clarke, Esq., Southwick Engine Works, Sunderland. As she left the ways she was christened by Mrs. Morgan, wife of the managing owner.

Carisbrooke.—On November 5th, Messrs. W. Gray& Co. launched from their north yard, at West Hartlepool, an iron steamer, having been built to the order of Messrs. Pearson and Foster, Whitby. She has the following dimensions:—Length, 262 ft.; breadth, 34 ft. 6 in.; depth, 19 ft. 8 in. The engines are to be fitted by Messrs. Blair and Co., Limited, Stockton-on-Tees.

Coningsby.—On November 5th, Messrs. W. Gray & Co. launched from their south yard, West Hartlepool, an iron screw-steamer of the following dimensions:—Length, 262 ft.; breadth, 34 ft. 6 in.; depth, 19 ft. 8 in., to the order of Mr. A. Gladstone, of the firm of Gladstone and Cornforth, West Hartlepool, and intended for Indian and general trade, to carry 2,400 tons. She is to be fitted with engines of 160 horse-power by Messrs. T. Richardson & Son, of Hartlepool, and with all the latest improvemepts including four steam-winches and steam-steering gear and patent windlass. On leaving the ways the christening ceremony was performed by Miss Lillie Nicholson, of Bootham, York, the vessel being named the *Coningsby.*

Teutonia.—On November 5th, Messrs. Schlesinger, Davis, & Co., of Wallsend, launched a screw-steamer, named the *Teutonia*, built to the order of Messrs. Ward & Holzapfel. She is classed 100 A at Lloyd's, and is of the following dimensions:—Length between perpendiculars, 290 ft.; beam, 37 ft.; depth, 25 ft. 9 in.; deadweight capacity, 3,400 tons. She his fitted with water-ballast in double bottom, has two iron decks, topgallant forecastle for crew, long bridge amidshipswith accommodation for officers and engineers, and short poop aft with accommodation for captain and passengers. The engines of 100 horse-power nominal, 1,000 horse-power effective, will be put on board by Messrs. Thomas Clark & Co., of Elswick. The christening ceremony was performed by Mrs. Holzapfel.

On November 5th, there was launched from the yard of Messrs. J. T. Eltringham & Co., at South Shields, an iron paddle-steamer of the following dimensions:—Length, 100 ft.; breadth, 18 ft.; and depth of hold, 9 ft. 6 in. She as been built to the order of Messrs. J. Hepple & Co., of South Shields, and is intended for towing purposes. As soon as the vessel was launched the boilers were put on board at Messrs. Eltringham's Quay, and she was subsequently towed to Messrs. Hepples' works to receive her engines, which are on the side lever principle, 35 in. cylinder and 40 horse-power.

Darjiling.—On November 5th, Messrs. Oswald, Mordaunt, & Co., launched from their shipbuilding and engineering works at Southampton, an iron sailing ship of 1,950 tons register, named the *Darjiling*, built to the order of Messrs. E. Bates & Sons, of Liverpool, and of the following dimensions:—Length, 268 ft.; breadth, 29 ft. 6 in.; depth of hold, 24 ft. The ship is built with full poop and monkey forecastle, large midship house for crew, and all the latest improvements for working the ship. She is intended to class 100 A 1 at Lloyd's, and 20 years in the Liverpool Underwriters' Registry. The ceremony of naming the vessel was performed by Mrs. Mordaunt.

Popenjoy.—On November 8th, there was launched from the yard of her builders, Messrs. Raylton Dixon & Co., a steamer, built for great speed either as a first-class yacht or a quick passenger steamer, which could shortly be fitted for either purpose. She is 222 ft. long over all, by 31 ft. beam, and 16 ft. 6 in. depth of hold; has a carrying capacity of 720 tons deadweight, and can be fitted with berths for 50 or more first-class passengers, either in deckhouse, poop, or 'tween decks. Her engines, by Messrs. R. & W. Hawthorn, of Newcastle, are capable of developing 1,350 indicated horse-power, which will give her speed at sea of 13½ knots. She was christened the *Popenjoy, pro tem.*, on leaving the ways, by Miss Amy Gertrude Nixon, the youngest daughter of the builder.

Principia.—On November 8th, a screw-steamer, built to the order of Messrs. Newton Brothers, Burton-on-Trent and Hull, was launched from the yard of Palmer's Shipbuilding and Iron Company (Limited), Jarrow. The vessel is 316½ ft. long, 32 ft. in breadth, and 28 ft. deep. She will be fitted with Palmer's engines of 300 horse-power nominal, the cylinders of which will be 38 and 70 in. respectively in diameter, and the stroke of the piston 48 in. The steamer is intended for the Indian and general trades, and will be supplied with every requisite for the rapid loading and discharging of cargo. The deadweight carrying capacity of the vessel, which is built to take the highest class at Lloyd's, is 3,000 tons. The ceremony of christening was performed by Miss Lily Newton, the name of the vessel being the *Principia*.

Elemore.—On November 8th, there was launched from the yard of Messrs. S. P. Austin & Son, Wear Dockyard, Sunderland, an iron screw-steamer, built to the order of Messrs. Sharp & Co., King-street, Newcastle, of the following dimensions:—Length over all, 223 ft. 6 in.; extreme breadth, 31 ft.; depth of hold, 15 ft. 2 in.; gross tonnage, about 980; nett tonnage, about 610; constructed with short full poop and break, bridge house and topgallant forecastle, iron decks, double bottom for water ballast. She will be fitted with compound surface condensing engines by the North-Eastern Marine Engineering Company (Limited), of 110 horse-power nominal. Emerson & Walker's patent windlass, and three steam-winches. As she left the ways she was named the *Elemore* by Miss Sharp, daughter of Mr. Robert Sharp, junr.

Silver Lining.—On November 9th, a barquentine, named the *Silver Lining*, was launched from the yard of Messrs. Upham Bros., Brixham, the ceremony of christening the vessel being performed by Miss C. Upham, second daughter of the builder. Her dimensions are:—Length of keel, 125 ft.; breadth, 27 ft.; depth, 14 ft. 11 in. Her registered tonnage is 350 tons, she is of 600 tons burthen, and is the largest vessel ever built in Brixham.

Sury Wongse.—On November 19th, the iron screw-steamer *Sury Wongse* ("Glorious Son of the Sun"), built by Messrs. Wigham, Richardson, & Co., was launched at Low Water. She is built to the order of a gentleman resident in Siam. It is the first steamer owned in that country. Her dimensions are:—Length, 248 ft.; breadth, 28½ ft; depth, 17 ft. She is fitted with Emerson, Walker, & Co.'s Patent Windlass.

Claremont.—On November 21st, from the shipbuilding-yard of T. and T. W. Smith, North Shields, there was launched a screw-steamer named the *Claremont*. Her dimensions are as follows:—Length, 180 ft.; breadth, 29 ft.; and depth, 13 ft. The engines will be of 100 horse-power, and will be fitted up by Messrs. Douglas & Grant, of Kirkcaldy. Her gross tonnage is 672, and she is classed 100 A 1 at Lloyd's. The *Claremont* has been built to the order of Messrs. Fisher, Renwick, & Co., Newcastle, to be employed in the Bilbao trade, and was christened by Mrs. Renwick. The *Claremont* was towed from the Tyne to the Clyde to have her engines put in.

Magician.—On November 21st, an iron sailing ship was launched from the building-yard of Messrs. Richardson, Duck, & Co., South Stockton, of the following dimensions, viz.:—Length over all, 264 ft.; length, b.p., 244 ft.; breadth extreme, 39 ft.; depth in hold, 24 ft. 3 in.; tonnage, gross, about 1,724; tonnage, nett, 1,667. She is classed 100 A 1 at Lloyd's and 20 years Liverpool, and has been built under special survey. The vessel has a full poop for the accommodation of first-class passengers and captain and officers, a topgallant forecastle, and deck-house amidships for crew, galley, &c. The ship has been built to the order of Messrs. Nevins, Welch & Co., Liverpool. As the vessel was leaving the ways she was named the *Magician* by Miss Burgess, daughter of the Rev. A. Burgess.

Archimede.—On November 22nd, Messrs. Alex. Stephen & Son launched a very fine mail steamer of about 3,000 tons, built to the order of Messrs. I. and V. Florio & Co., of Palermo, for whom Messrs. Stephen built two similar steamers last year. The vessel, which was named *Archimede* by Mrs. Whitson, Fitzroy-place, takes the highest class in Lloyd's, and combines all the most recent improvements in construction with a fine model, and the graceful—though now somewhat uncommon—cutwater bow, and figurehead. When launched, the *Archimede* had on board her machinery, consisting of compound surface-condensing engines, with cylinders 48 in. and 90 in. diameter by 48 in. stroke, and ample boilers, suitable for a pressure of 75 lbs. She has a double bottom on bracket principle for water-ballast, and is provided with all the best appliances for working ship and cargo; while the passenger accommodation is handsome, airy, and finished in excellent taste and style.

Athabasca.—On November 22nd, Messrs. M. Pearce & Co. launched, at Stockton-on-Tees, an iron screw-steamer of the following dimensions, viz:—Length, 300 ft.; breadth, 38 ft. 6 in.; depth, 27 ft., gross register tonnage about 2,522 tons, carrying capacity of about 3,800 tons. The steamer is specially adapted for the Atlantic trade, and will be classed 100 A 1 at Lloyd's. She is built off the three-decked rule, with double bottom for water-ballast, short full poop, bridge house, t. g. forecastle, and is fitted with four steam-winches, patent windlass, steam-steering gear, &c., &c. Her engines are of 300 horse-power, by Messrs. Blair & Co., of Stockton, on the compound direct acting surface condensing principle. As she left the ways Mrs. M. Pearse christened her *Athabasca*. She will be registered at Liverpool, and has been built for Messrs. Wm. Tapscott & Co., of that city.

Ruphar.—On November 22nd, the iron screw-steamer *Ruphar*, built to the order of Messrs. Joseph Robinson & Co., North Shields, was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), Willington Quay. The vessel, which has all the latest improvements, is classed 100 A 1 at Lloyd's. Her dimensions are:—Length, 287 ft.; breadth, 37 ft.; depth, 23 ft. 6 in.

Eleanor.—On November 23rd, a powerful paddle-wheel steamer, the *Eleanor*, intended for the London and North-Western Railway Company's service on the Holyhead and Greenore station, was launched by Messrs. Laird Brothers from their Birkenhead Ironworks. The *Eleanor* is the eighth vessel built by Messrs. Laird for this company, and is constructed entirely of steel manufactured at their Crewe works. Her dimensions are:—Length, 253 ft. 6 in.; beam, 30 ft.; depth in hold, 14 ft. 6 in.; with a tonnage of 1,118 tons O.M., and she will be fitted with two distinct sets of compound oscillating engines, which can be worked either together for regular work, or immediately disconnected by steam gear and worked independently for manœuvring the vessel in difficult circumstances. They are of about 2,000 indicated horse-power, and are expected to drive her at a very high speed. The passenger accommodation is contained in a full poop, entirely shut off from that part of the deck where the cattle are stowed. Fittings are provided for about 400 head of cattle, besides sheep; and special care has been devoted to the ventilation of the holds and 'tween decks, while the arrangements for the embarkation and landing of the cattle are adapted to make this as rapid and humane as possible. Protection from weather is given by a hurricane deck. The ceremony of christening was performed by Mrs. Bateson, wife of Mr. John Bateson, one of the directors of the company.

Catanian.—On November 23rd, Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw-steamer, built to the order of Messrs. Hugh Blaik & Co., of Leith. This vessel is No. 102 in the builders' yard, and is the fourth built for the same owners. Her principal dimensions are:—Length b.p., 285.0; beam extreme, 36.0; depth of hold to Lloyd's height of floor plates, 24.3½; and depth moulded, 25.2. She is built as a three-decked cargo boat to Lloyd's highest class, and has topgallant forecastle and long bridge-house, with water-tight ends, double bottom all fore and aft on the cellular principle, main deck of iron throughout, and upper deck of wood, four hatches and steam-winches, steam-capstan, windlass, and steam-steering gear; engines, of 200 nominal horse-power, will be supplied by Messrs. T. Richardson & Son, of Hartlepool Ironworks. As the steamer left the ways she was christened *Catanian* by Mrs. Henry Withy.

Saxon.—On November 23rd, Messrs. Turnbull & Son launched from the Whitehall Shipbuilding-yard, Whitby, an iron screw-steamer, built to the order of Messrs. Rowland & Robinson, of that port. The vessel, which was christened the *Saxon* by Mrs. Robert Wellburn, is of the following dimensions:—Length, 260 ft,; breadth, 34 ft. 6 in.; and depth of hold, 18 ft.; her deadweight carrying capacity, about 2,200 tons; engines of 140 horse-power, by Blair & Co., Stockton-on-Tees. She is intended for the Mediterranean and Black Sea Trade.

Jacob Christensen.—On November 23rd, Messrs. Raylton, Dixon, & Co. launched from their Cleveland Dockyard, a steamer named the *Jacob Christensen*, which has been built to the order of owners in Copenhagen. Her dimensions are:—270 ft. long by 34 ft. 9 in. breadth of beam, and 24 ft. 3 in. depth of hold. She will have a gross tonnage of about 1,800 tons, and a deadweight capacity of 2,500, at a draught of 22 ft. She is built on the three-deck rule, having main and other decks laid, and the latter of iron; water-ballast in large chamber in main hold forward of the engine-room, being in every respect a sister ship to the *Lesseps* (s) built by the same firm two months ago. She will be fitted with engines of 160 horse-power by Messrs. T. Richardson & Sons, of Hartlepool, and completed with first class outfit and most latest appliances for vessels of this class.

LAUNCHES.—Scotch.

Dredger No. 5.—On Oct. 24th, Messrs. H. M'Intyre & Co.

launched their shipbuilding yard at Merksworth, Paisley, the largest single dredging machine which has been constructed on the Clyde. This dredger, which has been built for the Dublin Port and Docks Board, is capable of dredging over 5,000 tons per day from a depth of 40 ft. below the surface of the water, or about double the amount guaranteed under the contract. The machinery has been constructed by Messrs. Fleming & Ferguson, Paisley, and consists of a pair of C.S.C. engines of 1,350 indicated horse-power for driving the dredging gear; auxiliary engines for hoisting and lowering bucket ladder, heaving chains by winches, warping hopper alongside; four powerful crab winches for shifting and feeding dredger when at work; steel-mounted buckets and tumblers, fitted with steel corner-pieces and bushes of same material. The ceremony of naming was performed by Miss A. Y. Fleming, of Paisley.

Cantonnais.—On Oct. 25th, Messrs. Scott & Co., Shipbuilders, Greenock, launched from their shipbuilding-yard, Cartsdyke, an iron screw-steamer, of 306 tons burthen, and engines of 60-horse power, and fitted with Emerson, Walker & Co.'s steam windlass. On leaving the ways the steamer was named the *Cantonnais*. This is the second of a fleet of six to be built by the Messrs. Scott to be used in connection with the French mail service in Cochin China, and she is similar in all respects to the *Phuoc Kien*, recently launched by them.

Stamboul.—On Oct. 26th, Messrs. A. M'Millan & Son launched from their dockyard at Dumbarton, the French mail steamship *Stamboul*, 2,200 tons and 1,700-horse-power. This steamer is to form one of the celebrated fleet of Messrs. Fraissinet & Co., Marseilles, and is intended for their Mediterranean mail, passenger, and cargo service. She has cabin passenger accommodation in the full poop for 40 passengers, and 24 passengers second-class have their saloon and rooms in the forward 'tween deck. The *Stamboul* received her name from Miss Allport, daughter of Mr. Dennison Allport, of the Royal Mail Steam Packet Company, London. The machinery is being supplied by Messrs. Denny & Co., Dumbarton. Messrs. M'Millan have another steamer yet to launch to complete their contract for four steamers tor Messrs. Fraissinet.

Saigan.—On Oct. 27th, Messrs. Caird & Co., Greenock, launched a steamer of 1,500 tons of the following dimensions:—Length on load water-line, 247 ft. 9 in.; beam (moulded), 31 ft. 6 in.; and depth (moulded), 21 ft. The steamer, which has been built for the Messageries Maritimes of Marseilles, will be supplied by the builders with engines of 250-horse power. On leaving the ways she was named the *Saigan*.

Santa-Cecilia.—On Nov. 3rd, Messrs. John Elder & Co. launched from their Fairfield Works, Govan, a steel screw steam yacht, of which the following are the principal dimensions:—Length between perpendiculars, 140 ft.; breadth, 22 ft.; depth, 12 ft. 3 in.; tonnage according to yacht measurement, 300 tons. The engines, which were fitted on board by the builders, are on the compound principle, with 18 in. high pressure and 36 in. low pressure cylinders, with 21 in. stroke, the steam being supplied at 100 lbs. pressure by one cylindrical boiler. The yacht, which has been built to the order of Lieut.-General Lord Alfred Paget, on leaving the ways, was named the *Santa-Cecilia*.

Duncrag.—On November 3rd, Messrs. Russell & Co. launched from their Port Glasgow yard a barque of the following dimensions.—Length, 200 ft.; breadth of beam, 32 ft. 6 in.; depth of hold, 19 ft. 7 in.; and of 900 tons. The new barque, which is named the *Duncrag*, has been built for Messrs. Dunn & Co., of Glasgow, and is the seventh vessel built by Messrs. Russell & Co. on identical lines.

Highland Chief.—On November 5th, there was launched from from Ramage & Ferguson's shipbuilding yard at Leith, an iron sailing barque of 900 tons nett register, for Messrs. Crane, Colvil, & Co., of Glasgow. Her dimensions are:—194 ft. by 32 ft. 6 in.; and 19 ft. 7 in. hold; and she is classed 100 A 1 in Lloyd's book. As the vessel left the ways it was named the *Highland Chief* by Miss Wear, of Felton, Northumberland.

Antonio Lopez.—On November 8th, Messrs. Denny Brothers launched from Leven Shipyard, Dumbarton, a screw-steamship for the Spanish mail service. She was named *Antonio Lopes*, by Miss Kate Risk, of Provanmill, Millerston. Her dimensions are:—Between perpendiculars, 370 ft.; breadth, moulded, 43 ft.; depth, moulded, 30 ft.; gross tonnage, about 3,430. She has been constructed of Siemens-Martin steel, under special survey of Lloyd's, and classed in their Registry 100 A 1, three-decked. She is built with a continuous cellular water-ballast bottom, with solid floors, on the system so extensively practised by Messrs. Denny, and will be fitted for 156 first-class passengers, 72 second-class, while accommodation for emigrants or troops to the number of 1,200 will be provided. The vessel will be fitted by Messrs. Denny & Co. with compound surface-condensing engines of about 4,000-horse power indicated, the cylinders being 57 and 102 in. in diameter, and length of stroke 60 in.

Odin.—On November 8th, Messrs. Lobnitz & Co. launched from their building-yard at Renfrew an iron screw-steamer named the *Odin*, and it was immediately placed in the builders' dock to receive the engines and boilers. This steamer will carry 2,000 tons cargo, and will have engines of 165 horse-power nominal of the compound surface-condensing type. The vessel will be commanded by Captain Sorensen, and the ceremony of naming the steamer was performed by his wife as the vessel moved off the ways. This steamer was launched under the Norwegian flag, and is understood to be the pioneer of a fleet of steamers which is likely to be soon afloat under the same flag.

Loch Torridon.—On November 9th, Messrs. Barclay, Curle, & Co., launched from their building-yard at Whiteinch, a four-masted sailing ship, 2,000 tons register, and of a deadweight carrying power of 3,200 tons. She is the property of the General Shipping Company, managed by Messrs. Aitken, Lilburn, & Co., and will take the berth as their December packet for Melbourne. On leaving the ways she was named the *Loch Torridon* by Mrs. Aitken, the wife of the managing owner.

Jolani.—On November 9th, the *Jolani*, an iron screw-steamer of 1,560 tons, built by Messrs. Murdoch & Murray, Port Glasgow, for Messrs. Raeburn & Verel, Glasgow, was launched. She is intended for the Eastern trade, is classed 100 A 1 at Lloyd's. She is built on the three-deck rule, with water-ballast in both holds, steam-windlass, steam-steering gear, lighthouses, &c., and will be fitted with compound surface condensing engines of about 170 horse-power nominal by Messrs. Kincaird, Donald, & Co., Greenock. The ceremony of christening was performed by Mrs. J. B. Verel, the wife of one of the managing owners.

Risveglio.—On November 10th, Messrs. H. M'Intyre & Co. launched from their shipbuilding-yard at Merksworth, Paisley, the *Risveglio*, an iron screw-steamer of 750 tons. She is built to the order of Signior Carlo Raggio, Genoa, and is intended for coasting traffic in the Mediterranean. She is classed 100 A 1 at Lloyd's, has water-ballast fore and aft, and all the latest improvements. Her machinery will be fitted on board by Messrs. Hutson & Corbett, Glasgow.

Ludgate Hill.—On November 9th, Messrs. Dobie & Co. launched from the Govan shipbuilding-yard the third of the steel twin screw-steamers, built by them for the Twin Screw Line of Liverpool, to the highest class, and measuring about 4,200 tons gross. As the steamer left the ways she was named *Ludgate Hill* by Miss Alexander, Clairmont-gardens. Owing to the continued inefficient supply of rivetting and caulking hands in the Clyde, this steamer has for a length of time been kept back in her progress towards completion of construction. She has proceeded to Clyde-villa Crane to be masted, and also to receive her machinery, which is being supplied by Messrs. James Howden & Co., engineers.

Sevilla.—On November 10th, Messrs. H. Murray & Co. launched from their Port Glasgow shipbuilding-yard, an iron screw steamer of about 800 tons deadweight capacity. This vessel, which has been built to the order of Messrs. H. Lamont & Co., Glasgow, was named *Sevilla* by Mrs. Boswell Sandeman, Ferndean, Lenzie. The *Sevilla* has been built to the highest class at Lloyd's, and is fitted with about 140 tons water-ballast in double bottom, three steam-winches, and all the latest improvements. Immediately after the launch she was towed to Glasgow to receive her engines of 100 nominal horse-power, which are being supplied by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow. She is intended for the fruit and ore trades.

Clynder.—On November 12th, Messrs. Russell & Co. launched from their shipbuilding-yard at Cartsdyke, Greenock, a barque of 1,100 tons, built to the order of a Glasgow firm. The barque which, as she left the ways, was named the *Clynder*, is 220 ft. in length, 34½ ft. in breadth, and 21 ft. in depth. She is to be engaged in the Sydney trade.

Jean Dupuis.—On November 12th, Messrs. Scott & Co., shipbuilders, Cartsdyke, launched from their yard an iron screw-steamer of 308 tons burthen, with engines of 60 horse-power. This steamer is the third of a fleet of six to be built by the Messrs. Scott, and is similar in all respects to the *Phuoc Kien* and *Cantonnais*, already launched, and now almost ready for sea. On leaving the ways the steamer was named the *Jean Dupuis*, and was afterwards taken to Victoria Harbour to be fitted out. These steamers, as already intimated, will be used in connection with the French Mail Service in Cochin China.

Bothnia.—On November 12th, a steamer was launched from the yard of the Campbeltown Shipbuilding Company, of the following dimensions:—Length, 215 ft.; breadth, 32 ft.; depth, 15 ft.; with long quarter deck, midship house, and topgallant forecastle. The steamer has been built under special survey to class 100 A 1 at Lloyd's. She is provided with water-ballast, steam-winches, and every modern improvement for securing safety, combined with economy and rapid dispatch. The steamer has been built for the Baltic Steamship Company (Limited), of London, of which company Messrs. Weguelin, Eddowes, & Co. are the managers. As she left the ways the vessel was christened the *Bothnia* by Mrs. Eddowes, wife of one of the managers, and at once proceeded to Greenock, where she will be fitted with engines and boilers of the most modern type, by Messrs. Kincaid, Donald, & Co., of Greenock.

Catharine, DE., 453.—On November 19th, a large fishing-boat was launched from Messrs. Scott's shipbuilding-yard, Dundee. She has been built for a Broughtyferry crew, and is named the *Catharine, DE.*, 453. The following are her dimensions:—Length of keel, 53 ft.; width of beam, 16 ft. 8 in.; burthen, 37 tons. She is divided into compartments for the different kinds of fish, and has a cabin and a forecastle for the accommodation of the crew.

Neptune.—On November 23rd, a new iron twin-screw dredger of 700 tons, built and engined by Messrs. W. Simons & Co., was launched complete from their works at Renfrew. It is named *Neptune*, of Fleetwood, and is the property of the Lancashire and Yorkshire Railway Company, and is intended for the improvement of the ports in connection with their line. The *Neptune* is fitted with compound engines of 100 horse-power, and two boilers, and is the second dredger constructed by this firm for the Lancashire and Yorkshire Railway Company.

Leonora.—On November 23rd, the London and Glasgow Iron Shipbuilding and Engineering Company launched from their yard at Grovan an iron screw-steamer, built to the order of Messrs. J. T. Nickels & Co., Liverpool. The vessel, which was named the *Leonora* by Miss Goodwin, will form an addition to the fleet of vessels sailing under the flag of the Linea de Vapore Serra, Bilbao, trading between Liverpool and Havana. The *Leonora* is a well-proportioned vessel of about 2,600 tons, with the following dimensions:—Length, 345 ft.; breadth, 37 ft.; and depth, 25 ft. 9 in. She is classed 100 A 1 at Lloyd's, and also carry 1 3-3 L1.1 Bureau Veritas. Besides having extensive cargo-carrying facilities, the new ship will also be constructed to accommodate a limited number of passengers. She will be fitted by her builders with compound surface-condensing engines, of the most approved description, of 300 nominal horse-power.

Scotia.—On November 23rd, a steamer was launched from the shipbuilding-yard of Messrs. S. and H. Morton & Co., Leith. The total length of the vessel is 337 ft.; breadth of moulded beam 40 ft.; moulded depth 26 ft. 6 in.; and about 2,500 tons burthen. The vessel, which was named the *Scotia*, will be employed in the goods and emigrant Transatlantic trade between Marseilles and New York.

Omniopolis.—On November 24th, Messrs. Scott & Co. launched from their building yard at Bowling, a screw-steamer of about 300 tons, for coasting trade. The vessel, which is named the *Omniopolis*, takes the highest class in Lloyd's, being built under special survey, and under the superintendence of Mr. James Donaldson, consulting engineer. The engines, on the compound surface-condensing principle, are being supplied by Messrs. J. and T. Young, Ayr.

LAUNCH—IRISH.

Mary Armstead.—On November 8th a three-masted schooner was launched from the shipbuilding-yard of Mr. Paul Rodgers, of Carrickfergus. The vessel's dimensions are:—Length, 93 ft.; breadth 22 ft.; depth of hold, 9¾ ft. She will register under 100 tons, and carry above 200 tons, and she is classed 12 years A 1 at Lloyd's. The ceremony of christening was performed by Mrs. Cox, Ramoan Rectory, Ballycastle, who named the vessel the *Mary Armstead*. The *Mary Armstead* has been built to the order of Messrs. James Fisher & Sons, of Barrow-in-Furness. She is intended for the general coasting trade, and will be commanded by Captain Jones.

LAUNCHES.—SWEDISH.

Nanna.—On November 11th, there was launched from the yard of the Motala Company, at Lindholmen, near Gothenburg, a screw-steamer named *Nanna*, built of Motala Bessemer steel, to the order of Mr. John Giertsen and others, in Bergen, Norway. The *Nanna* is built to class at London Lloyd's, with raised quarter-deck for the Mediterranean and Baltic trade; and is of the following dimensions:—Length, 159 ft.; breadth, moulded, 24 ft. 10 in.; depth of hold, 15 ft. 6 in.; with a carrying capacity of 600 tons dead weight. She will immediately receive her engines of 50 nominal horse-power.

Polyxene.—In October last, there was launched from the shipbuilding yard at Motala a steel screw-steamer of the following dimensions:—Length over all, 85 ft.; breadth, moulded, 16 ft.; draught of water, 6 ft. The vessel was named *Polyxene*; is built to the order of Grefere Knuth, of Knuthenborg, Denmark. At a later made trial trip the engine of 25 nominal horse-power gives the ship a speed of 8·97 knots, with a coal consumption of 216 lbs., instead of 8·75, with 225 lbs., stipulated by contract.

TRIAL TRIPS.

Behera.—On October 25th, this vessel, having been fitted with new engines by Messrs. James Jack & Co., of Liverpool, ran a trial trip from the port of Alexandria. The *Behera* was built by Messrs. Samuda Brothers, of London, in 1865, and was engined by Messrs. John Penn & Son, of Greenwich; her total cost being £85,000. She had new boilers, and was completely refitted in London in 1872 by the same firms, and, till within the last twelve months, was continuously engaged in the postal service between Alexandria and Constantinople, as one of their fastest and most reliable vessels. On one occasion, when engaged on special service, she made the run from Alexandria to the Dardanelles within forty-eight hours. The new engines are constructed by Messrs. James Jack & Co., of Liverpool, and are of 300 nominal horse power, working up to 1,500 indicated horse power, they are precisely similar to those in the *Charkieh*. The results of the run on October 25th realized every expectation. The highest speed obtained was 13·4 knots with sixty-seven revolutions and 70 lb. of steam and 27 in. vacuum, the indicated horse power at this speed and pressure being over 1,500 lb., and the consumption of coal at the rate of nineteen tons per twenty-four hours.

Cachapoal.—On October 25th, the steamer *Cachapoal* took her trial trip. Her dimension are—Length, 320 ft.; beam, 40 ft.; depth of hold, 21 ft.; tonnage O,M., 2,519 tons; and fitted with a set of Messrs. Laird's direct-acting inverted compound engines, having cylinders 45 and 80 in. in diameter, with 4 ft. 6 in. stroke, supplied with steam at 75 lb. pressure from four cylindrical boilers, and calculated to develop about 2,000 horse power. She was built by Messrs. Laird Brothers, to the order of the Compania Sud Americana de Gapores. She started, at 11 a.m., from the Birkenhead dock, proceeding down Channel to Point Lynas, making a long circle to the northward, and was kept underweigh the whole day, returning to the river at 9 p.m., the engines making up to 65 revolutions, developing over 2,000 imperial horse power; speed over 14 knots made for two hours consecutively. No signs of heated bearings, and everything satisfactory; engines working smoothly.

Spartan.—On November 3rd, the screw-steamer *Spartan*, of the Union Steamship Company, made her trial trip in the Clyde. She is the largest vessel yet constructed for the Cape of Good Hope service, her dimensions being 365 ft. long, breadth, 43 ft.; depth, 32½ ft.; and gross tonnage 3,750. She will carry 150 first, 50 second, and 100 third-class passengers. The saloon is 43 ft. square and is in the centre of the vessel, and elegantly fitted up. She is one of four vessels which the company are adding to their fleet. The trial trip was eminently satisfactory.

Schaldis.—On November 7th, the trial trip took place of the *Schaldis* (s), built by Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, for the Société Anonyme Anversoise d'Armemant et de Transports Maritimes, John W. Hunter, managing director. The *Schaldis* is of the following dimensions:—Length between perpendiculars 285 ft.; breadth, 36 ft.; depth of hold, 24 ft.; is classed 100 A 1 under special survey of Lloyds, is fitted with engines 35 and 68 in. diameter and 45 in. stroke, made by the Wallsend Shipway & Engineering Co. (Limited), and will carry about 3,000 tons dead weight, and is intended for the Indian trade. She is fitted with Emerson, Walker & Co's steam-windlass. The steamer made an average speed of 11·53 knots at the measured mile, and the trial of ship and machinery was highly satisfactory.

Bretwalda.—On November 7th, the new type of cargo steamer, the *Bretwalda*, which was launched a few weeks ago from Palmer's Shipbuilding-yard at Jarrow, to the order of Messrs. Hall Brothers, had her trial trip. The vessel is 330 ft. long, 39 ft. broad; and 29½ ft. deep; and is capable of carrying 3,600 tons. Her chief feature is that she has an awning deck, being covered in from stem to stern, with an open rail, so that should the sea sweep over her, the water will find no lodgment. She is intended for the general carrying trade, but is fitted up so as to be able to carry cattle or horses on the main deck, where accommodation could be provided for 300 animals. She is fitted with every appliance for economizing labour, including steam gearing, and has ample means for ventilating and feeding the cattle, and for condensing the water for them. She has a freeboard of fully 10 ft., and the load-line has been fixed by Lloyd's. She is suited either for the American or East Indian trades. Several seafaring men were on board, in addition to a number of gentlemen, and after the engines had been tried and the compasses adjusted, she steamed away on her first voyage.

Spartan.—The Union Steamship Company's new ship *Spartan* was taken out on November 11th for her official trial at the measured mile in Stokes Bay, and attained a mean speed of over 14¾ knots. She will leave with the Cape mails on the 17th inst.

Candace.—On November 14th, the new iron auxiliary steam-yacht *Candace*, 400 tons, went out on her official trial on the Firth of Forth, with the most satisfactory results. After leaving Leith she was steamed down to the new measured mile at Gullane, a few miles west of North Berwick, and had the first trial over it that has ever been made by any vessel. With her two-bladed Bevis feathering propeller set at a pitch of 14·3 a speed of 12·245 knots was attained; but, on subsequent runs, when the pitch was altered to 15·3, the result was even better. A run was afterwards taken out to the Bass Rock, and the steaming and sea-going qualities of the vessel thoroughly tested. The *Candace* has been built for Mr. Lysaght, of Bristol, by Ramage & Ferguson, Leith, who also built the *Titania*, three years ago, for the same owner.

Ivanhoe.—On November 19th, this steamer, which was launched a few weeks ago from the shipbuilding-yard of Messrs. Murdoch & Murray, Port Glasgow, for Messrs. George Hood & Co., Glasgow, made her final trial trip. On running the measured mile at Skelmorlie, on the Firth of Clyde, she attained a high rate of speed, the engines working most satisfactorily, and reflecting great credit on Mr. William Kemp, of Govan, near Glasgow, who supplied them. This steamer is intended for the Spanish trade, and is equipped with every modern improvement. She is now loading at Glasgow for Valencia.

Supply.—There was a six hours' full-power trial in the Solent on November 23rd, of a somewhat novel craft, called the *Supply*, which is intended for Her Majesty's service as a tank vessel for the supply of water to ships on the Bermuda Station. She was built by Messrs. Laird Brothers, of Birkenhead. Her dimensions are 104 ft. between perpendiculars; 19 ft. 6 in. in extreme breadth; and 8 ft. 9½ in. in depth of hold; while her load displacement is 250 tons. She is propelled by a single screw, which is driven by a set of vertical compound engines having cylinders of 13 in. and 24 in. respectively, with a stroke of 1 ft. 3 in., and contracted to indicate 120 horse-power. The vessel is provided with powerful pumps capable of delivering from 80 to 100 tons of water per hour, and is fitted with steam fire-engine and towing appliances, which will greatly add to her usefulness on the station. At the trial, which was made by the officers of the Steam Reserve, the tanks in the fore-part of the hull were full of water, which made her draught 8 ft. 6 in. forward, and 7 ft. 2 in. aft. The mean pressure of steam in the boilers was 68½ lb., the revolutions of the engine were 162, and 119 horse-power was developed. The average speed registered by the patent log was slightly over eight knots, but the mean of six runs on the measured mile gave a speed of 7·574 knots an hour, which, in view of her trim, is satisfactory.

Steam Pinnace.—The series of trials during the last month of the steam pinnace purchased by the Government from the Herreshoff Manufacturing Company, of Bristol, Rhode Island, United States, were conducted at Sheerness in the presence of Rear-Admiral T. Brandreth, A.D.C., the new Controller of the Navy, Mr. A. J. Dunstan, chief inspector of machinery at Sheerness Dockyard, the principal officers of the Medway Steam Reserve, and the leading officials of the engineering department of Sheerness Dockyard. The Admiralty have two of these pinnaces to test, with a view to their introduction into the Navy. They are 33 ft. in extreme length, and 8 ft. 9 in. in extreme breadth, with a mean draught of 1 ft. 7 in. The displacement is about 9,000 lb. The weight of the vessel, including the machinery, is about 6,000 lb. The boiler used is Mr. Herreshoff's patent safety coil boiler, by means of which 60 lb. of steam can be got up within six or seven minutes. The engines are of the simplest design, being of the compound type. There are two cylinders connected at right angles, as this gives the engine more perfect control of the vessel as regards stopping, &c. The pinnaces are supposed to carry 1,120 lb. of coal and a small tank to hold the water required for the engines, which is comparatively little, as the engine is condensing while at work, this being accomplished by the steam passing through a pipe secured to the bottom of the boat and passing round the stern to the boiler again. The trials of the engines were very satisfactory, and the conclusion arrived at generally is that the vessels are considerably superior to the Navy pinnaces in many respects, and more especially in speed, but it is feared that they are not built strong enough to carry the torpedo gear and heavy weights required in Navy pinnaces. Mr. Herreshoff, the inventor of the pinnace, who is blind, was present at the trials.

Phosphor Bronze.—A private trial trip of this steam launch, the property of the Phosphor Bronze Co., Lim., London, took place in the Thames on Tuesday, 22nd ult. This small vessel is built entirely of phosphor bronze, and her length is only 35 ft., her beam about 6 ft., and she attained a speed of about 12½ miles per hour, which, considering her size, is a remarkable performance. The chief object of the Company in having so small a craft built was to test the rigidity of the phosphor bronze sheet and angle-pieces used in her construction prior to having boats built on a larger scale, the result having been beyond the Company's expectation as regards rigidity, absence of vibration, and the speed attained. We understand that the cost of phosphor bronze boats will not much exceed those made of steel, and the metal is not subject to corrosion like iron or steel, and retains its value. We expect to hear soon of several steam-launches, torpedo-boats, &c., being built of phosphor bronze.

Servia.—On November 17th, the *Servia* arrived in the Mersey, the largest and latest addition to the Cunard line, and one of the finest specimens of marine architecture in the world. She was launched last March from Messrs. J. & G. Thomson's yard on the Clyde, and would have been at work earlier but for the discovery of a flaw in her crank-shaft. This has been remedied by the removal of two of the cranks and the substitution of two others made of Vickers's steel, and built on to the sternmost crank, which was proved to be sound. On her trials before leaving the Clyde, it was shown that her engines indicated 10,385 horse-power. They are composed of three cylinders, one high-pressure of 72 in. diameter, and two low-pressure of 100 in., with a stroke of 6 ft. 6 in. The trials were numerous, and four of them at the measured mile gave a mean of 17·629 knots per hour. The time occupied for each mile was 3 min. 29 sec., 3 min. 23 sec., 3 min. 23 sec., and 3 min. 22 sec. The speed in each case respectively was, therefore, 17·225 knots per hour, 17·734, 17·734, and 17·823. In a run of 14 miles from the Clock Light to the Cumbrae she ran at a speed of 17·58 knots, or about 20 statute miles per hour. The highest speed at the measured mile reached a rate of 20½ statute miles per hour. The propeller made 53 revolutions with steam at 80 lb. pressure out of an available 90 lb. The trials were made in the presence of Mr. John Burns, the chairman of the Cunard Company, who also made the journey round to the Mersey to note her behaviour at sea. He was accompanied by the Marquis of Ailsa, Mr. James Dunn, of the Admiralty, and Mr. Thomas Gray, of the Board of Trade. The weather was unpleasantly rough, but the waves had comparatively little effect upon the vessel when in motion. Her great length of 530 ft., with a breadth of 52 ft., gave her unusual steadiness, and presage a smooth journey across the Atlantic. The presence of Mr. Dunn at the trials naturally directs attention to the qualities of the *Servia* as a vessel for purposes of war, supplemental to the regular Navy. It has been found by experiment that eight feet of coal will stop a shot from a 64-pounder, and that a shell will explode harmlessly in far less. The engines and boilers of the *Servia* are surrounded by water-tight compartments available for the reception of coal 10 ft. in thickness. This would give complete protection to the vital parts of the ship. Besides this, the whole length of the vessel is divided by nine water-tight bulkheads, each of which is, to all intents and purposes, a separate ship, provided the doors are closed at the time of danger. Contrary to the usual practice, the doors can in this case be closed by a lever on the main deck. The ship itself is built of steel, and has a double skin, so that were the outer plates broken the ship would still be safe. The upper, main, and lower decks are also of steel, covered with pine on the upper deck and teak below. It is held that both for ordinary safety, as well as for war purposes, steel will give greater resistance, by reason of its elasticity, than iron in the event of concussion. It offers one chance more than iron, because it will rebound where iron will crack. For transport service the *Servia* would offer exceptional advantages. She has capacity for storing coal enabling her to steam 22,290 knots without entering a port at a rate of 12 knots per hour, or 17,000 knots at a rate of 14 per hour; or, in other words, she could cruise for two or three months at a fair speed all the time. It is satisfactory to know that the Admiralty has at present a list of upwards of 200 ships, all of which have complied with the conditions of the department, so far as construction is concerned, though they may not all be as efficient for war purposes as the *Servia*. A large number of others are building at the present time in accordance with the same rules, and it is anticipated that the Admiralty will, at an early date, secure the use of the majority of them in case of necessity. There is, we believe, at present armament for 30 vessels ready for shipment at 24 hours' notice—an armament consisting, so far as ships of the character of the *Servia* are concerned, of six 64-pounders and four 40's, or ten guns with men to work them. The British mercantile marine consists now of ten-and-a-quarter million tons, four-and-a-half being steam and five-and-three-quarters sailing. The whole of the foreign tonnage amounts to eleven-and-a-half million tons, of which two-and-a-half millions are steam and nine millions sailing. These figures show very clearly the necessity, as well as the opportunity, for procuring fast-going cruisers for the defence of our mercantile marine, and the necessity will be emphasized by the fact that the agents of the French, German, and Russian Governments are following in the footsteps of the Admiralty, and collecting information as to where ships are to be bought in this country that may be turned to account as fast-going cruisers, armoured, with coal in water-tight compartments, and armed with long-range guns. It is fortunate that the requirements of the Admiralty do not interfere with the comfort or safety of the ordinary passenger nor with the cargo-carrying capacity of the vessel. The safety of the ship is indeed materially increased by compliance with these conditions; and the water-tight compartments which the Admiralty design for the storing of coal for defensive purposes are available for cargo or accommodation for the crew. The comfort of the passenger is consulted in the *Servia* by a variety of contrivances, including berths of unusual width, and by the adoption of the electric light in the saloons and smoking room, as well as the engine-room and stokehold. The electricity is generated by one of Brotherhood's three-cylinder engines, directly acting on an electro-dynamic machine, and producing 640 revolutions per minute. The electricity generated is sufficient for 117 of Swan's incandescent lights and two arc lights on deck for loading purposes.

Empire.—The new steamship *Empire*, which has been built by Messrs. R. and I. Evans & Co., to the order of Messrs. W. Thomas & Co., went on her trial trip on Thursday, November 3rd, having on board a select company of gentlemen interested in the vessel. Her dimensions are 280 ft. long, 35 ft. 8 in. in breadth by 24 ft. 7 in. depth of hold, with a gross registered tonnage of about 2,000 tons, and is built to the highest class in Lloyd's. The vessel is fitted with a pair of compound direct-acting surface-condensing engines, having cylinders 33 in. and 66 in. diameter, with a stroke of 42 in., and one steel boiler, having six furnaces, supplying steam at a working pressure of 80 lb. per square inch. Her engines, which combine all the latest improvements, have been constructed by Messrs. David Rollo & Sons, of this city, under the superintendence of Mr. Gilbert S. Goodwin. The trial was in every way a success, everything working smoothly, and with no indications of heating. At 66 revolutions per minute the vessel attained the speed of about 11 knots per hour. Although the weather was rather unfavourable, all on board expressed themselves highly satisfied with the day's run.

ERRATUM.

To the Editor of THE MARINE ENGINEER.

Alexandria, Oct. 20th, 1881.

SIR,—In your account of the trial trip of the *Charkieh*, in your number for October 1st appears a curious error which we see has also crept into other papers. We are made out as the constructors of the engines, along with Messrs. Jack & Co., Liverpool, whereas that firm alone made the engines, we acting in Egypt as their agents. Kindly insert this in your next number after receipt.—Yours truly,

ALLEN ALDERSON & Co.

P.S.—Please also note our firm is Allen Alderson—not Anderson & Co.

Reviews.

The Practical Guide to the use of Marine Steam Machinery.—By JAMES DONALDSON: Published by Chas. Wilson, of Leadenhall-street.

This is a thoroughly practical book, written to provide information in regard to the handling of engines and boilers of steam yachts and launches. It is plain and simple enough for the use of non-professional engineer yachtsmen, and yet is full of general information and hints of use to all sea-going engineers. The book opens with instruction as to the lighting up and starting of boilers and engines. Then follows good advice as to the remedying of little failings to which engines and boilers are liable, such as "knocking" and "priming." Many good precautions to prevent accident and explosions are pointed out, and the setting of valves, packing of glands, and details of management are all described with much good advice. The remaining body of the book is occupied with minute descriptions and dimensions of a great variety of engines, launches, boilers, and fittings, so that it forms a compendium of all that is good and new of that description in the market. The work will thus serve to keep the sea-going engineer up in all that is being done and invented in launch and torpedo practice, or will serve as a means of information to the yachtsman or amateur as to what is best worth his choice and attention. The illustrations are numerous, and greatly aid in giving clear examples to suit the descriptions. The book is altogether well got up, and worth reading.

Stock Requisition and Private Log-book.—By JAMES DONALDSON: Published by Chas. Wilson, Leadenhall-street, London; also in Liverpool and Glasgow.

This little memorandum-book will serve as an excellent means to induce the keeping of a regular and systematic diary or log-bog throughout a voyage. No engineer can tell what importance the dimensions of his engines and boilers, or the systematic detail of daily occurrences may prove to him. It is easy to keep a note of these facts, if suggested and done daily, and the result would prove a most interesting note-book of reference. In this little memorandum-book will be found tabulated all the details as to daily events, requisition lists, dimensions of parts, &c., that are likely to prove useful, and the very tidyness and compactness of the arrangement is in itself an overwhelming inducement to fill it up.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

"STATUS" OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—The suggestions thrown out by your correspondent "Wane" in No. 30 are excellent; there yet remains the difficulty of forming a committee or responsible party who may be able to correspond with the B. O. T. in the Shipowners' Association. I have no doubt, Sir, that the majority of your subscribers are sea-going engineers, whose spare hours are devoted to their homes; who, from the nature of their occupations, have no time to take part in the management of any club. There are Sea-Going Engineers' Associations, and an excellent one at 721, Commercial Road, London, W. H. Sissons, Secretary. This has for its object the discussion of practical subjects, and aims at elevating and improving the condition of the marine engineer. This institute is, I believe, competent and sufficiently influential to bring the subject "Tonnage dues for all enclosed spaces before the B. O. T." and Shipowners' Association.

I am informed that there are clubs of marine engineers in most of our important seaports. Would it not be as well if such clubs would advertize, and bring their aims and benefits before us all?

I remember some years ago there went up the cry "Oh! what we want is a paper, a medium through which we can make known our positions and requirements; the rest will follow." The MARINE ENGINEER has been established some years, yet we are no better off than formerly. Everything has a downward tendency, notwithstanding that duties and responsibilities have increased. Having, then, such a valuable paper and medium, I hope patronized by every marine engineer and apprentice, and having also associations in different ports of the United Kingdom we only now require some competent and honest party to consolidate and amalgamate the different clubs. Considering the thousands of marine engineers afloat it seems lamentable that so many should be dependent upon the charity of such institutions as, for example, the Liverpool Seaman's Orphan Institute. I maintain that we ought to be able to support our aged, our destitute, our sick, and the orphans. I believe it possible to organize a sound insurance and annuity fund in connection with the proposed Association, one that receives the approbation and co-operation of the marine engineers in all countries. It is to be done. Who will move in it?

I am, Sir, your obedient servant,
Amalgamation.

LOSS OF LIFE AT SEA.

To the Editor of The Marine Engineer.

Sir,—In your number for October I read a letter by Mr. Thos. Cornish, on "Loss of Life at Sea," and I think a few sensible letters such as his might induce the owners of vessels to provide their ships with a better outfit of life-saving appliances.

There are hundreds of small vessels from 100 to 1000 tons trading about the English coast and to ports on the Continent, each carrying a crew of from 10 to 30 men, and yet in many of these you will find only one or two life-buoys.

I am not aware as to whether there exists in Great Britain any law as to the number of life-buoys a ship should carry, but I certainly think that every ship should carry one for each member of the crew, and, if a passenger ship, one for each passenger. I was very much impressed with the great necessity of providing life-buoys on reading an account of the loss of the s.s. *Cyprian*, of Liverpool, during the recent heavy gale, in which case it appears that each individual saved wore one; but it seems to me that even that ship was insufficiently provided, as I read of the captain giving his life-buoy to a stowaway. He, being a swimmer, undoubtedly thought that he might manage to swim ashore, but the elements overpowered him, and he (with others not provided with life-buoys) was lost.

I would further suggest that the life-buoys be kept in some convenient spot on deck, so that in case of emergency, such as sudden foundering of a ship, where there is no time to lower the boats, or the sea too rough for any boat to live, each man might help himself to one. They are often stowed away, and, when wanted, there is sometimes a difficulty in finding them: certainly a great loss of time. The use of beds, pillows, cushions, and other articles about a ship's furniture with sufficient buoyancy to sustain one or more persons, as suggested by Mr. Cornish, would be a great boon. I do not think that shipowners are much to blame in not providing the necessary means for saving life, but sea-faring men themselves for not impressing upon the owners the great necessity for such appliances. I think a few practical letters through the medium of your valuable journal would have great effect.

Yours truly,
Hy. Williamson,
Barcelona, 11th Nov., 1881. Chief Engineer, s.s. *Henry*.

ANTI-CORROSIVE AND ANTI-FOULING COMPOSITION.

To the Editor of The Marine Engineer.

Sir,—I can fully endorse the opinions expressed by your correspondents in your October number relative to the coating of ships' bottoms, viz., that generally the failure is attributable to the, one may say, disgraceful manner in which the composition is applied, which is always put down to the composition itself.

I have been in dock with steamships where actually a fire has been lit under the bottom to dry up the wet, and then the composition has been put on. I have heard the vendors of various compositions in one case explain to owners that their composition was better put on just before the ship took the water; this is when they hear the vessel is to be in the dock two or three tides only. At other times I have heard the same composition, when the ship was going to be some time in dock, especially recommended, as each coat must be thoroughly hard and dry before the next one is applied.

I have had excellent, and also very bad, results from Rahtjen's, and Blundell & Spence's compositions, both on same voyages and same vessels, and could have prophesied very nearly the results before the ship left the dry dock, and have simply formed the opinion on the state of the bottom before coating and the mode of application of the composition. I have come into dock and found the bottom, as one of your correspondents justly terms it, as foul as a half-tide rock, after being in the water only a few months, and have come into dock, after a period of twelve months, and found the bottom very little worse than when the ship took the water, and this with the same composition on, and her having run in the same waters. And, strange to say, this latter condition of bottom has sometimes formed the excuse for not thoroughly coating the bottom again.

I think myself that a great portion of injury, which is never recovered, is done in the first few months of a vessel's history, and in the manner the composition is put on before launching.

I know of a steamer that was properly coated when built, and had to go into dock some few months after launching, and, much to the astonishment of a good many, there was scarcely a particle of anti-fouling or anti-corrosive composition on bottom, and the surveyor of a registry remarked, it was a lucky accident that put her in dock, for, he said, if she had run her twelve months her bottom would have very sadly deteriorated, as even then her rivet-heads were much pitted and edge of plates damaged.

My firm belief is that the plates of a new steamer being coated over a slope surface, when the bloom of the iron is on, is partly, if not the only solution, to this early deterioration to an iron ship's bottom.

I cannot but think that if a slight coating of rust should be allowed to form, or made to form, artificially, on the plates when building, and then rubbed down with pumice-stone or some other substance, and then the red lead, or other anti-corrosive, well rubbed into the pores of the iron, that the ships' bottom would show a very different result to what they now do. And that if the anti-fouling composition was found to be worn off the anti-corrosive would be found to be pretty well intact, and form the foundation of further applications, which, if put on fairly, would preserve the ship's bottom and present a smooth surface to the water; also, lessen materially the expense of succeeding applications—instead of its being, as it invariably is, coatings—and, consequently, none of them having to be put on bare surfaces at each docking, when the ship's bottom looks like a surface of decayed cement and full of large blisters. If the above is not, partly or wholly, the reason of the deterioration, I can only assume that the iron forming the plates is not of such a good quality as the shipowner assumes it to be.

I am, Sir, yours truly,
"An Enemy to False Economy."

SEA-GOING ENGINEERS' ASSOCIATION.

To the Editor of The Marine Engineer.

Sir,—In your November part "Landsman," calling attention to the Sea-Going Engineers' Association is unable to see any improvement, owing to the craft having few ideas, from this I take it that he is well acquainted with the craft and their ideas, and is watching the progress of the association. Possibly "Landsman" has some good ideas, and, if so, I should like very much to have a personal interview with him, so that his ideas, if better than ours, might be adopted. Yet I must inform "Landsman" that competent engineers are not made in a year or two, therefore, associations of engineers will require time to accomplish the ideas the craft has got in view. In 1872 a similiar association was started, but for want of ideas the same as ours, it soon broke up. "Landsman" possibly has got some of the old ideas, and, if so, they will be of no use to us, for we have improved upon them and conducted the association to the satisfaction of the members for two-and-a-half years, and our funds have increased, so that now we are able to employ a solicitor, not so much for new ideas, but to defend its members in obtaining their just rights. Hoping, Mr. Editor, that I am not trespassing over much on your valuable space,

I am, Sir, yours truly,
William Ayre, General Secretary.
12, Hendon-road, Sunderland, Nov. 19th, 1881.

SAVING LIFE AND PROPERTY AT SEA.

To the Editor of The Marine Engineer.

Sir,—Through the medium of your valuable journal I wish to bring before the public, especially men in my own position, a few simple ideas which, though simple, may add to the means of saving, not only the lives of men going to sea, but the valuable property committed to their charge.

I would suggest that every steamship going to sea should be supplied with a set of indiarubber hose, the internal diameter of which should be the same as the outside diameter of the bilge suction pipes, made of sufficient thickness to prevent collapsing, with a clasp or flange on one end as may best suit, so that in the event of the ordinary suction pipes becoming choked they might be taken off from the pump or cut off, and the india-rubber hose attached. The hose should be left long enough to reach almost round the engine-room, as in case of the limber holes getting stopped, they can be shifted from one place to another as required; there might be a strum attached to the loose end.

I would also suggest the advisability of having discharge pipes leading from the bilge pumps to the deck, with non-return valves half way up the pipes, so that, in case of the ordinary discharge pipes becoming choked at the ship's sides, these might be used.

I have known where there was great danger in clearing the discharge valve-chest on the ship's side through the force of the water coming back, owing to the heavy rolling of the ship. This danger is greatly increased when these pipes pass through the coal-bunker, as there is more difficulty in getting at them, and in this way what is intended for the safety of the vessel may add to the cause of her being lost.

The cost of carrying out these few simple suggestions would not be much, and the benefit derived therefrom might be very great.

I remain, Mr. Editor, yours truly,
JOHN MACNAIR,
Chief Engineer, s.s. *Countess of Dublin.*
North Wall, Dublin, Nov. 21st, 1881.

LUBRICATION OF REFRIGERATORS.

ALL users of machinery are agreed as to the great importance of a careful selection of an efficient lubricant, both for running bearings and for the internal portions of their machines, such for example, as the pistons and slides of steam-engines. We are afraid also it must be added, that notwithstanding the many high and low-priced preparations offered for their acceptance, most users have had to admit the difficulty in finding such a suitable lubricant.

On a previous occasion we called the attention of our readers to the very excellent properties of "Engelbert's Lubricator," properties which, from actual experience, it has been proved to possess, and which have led to the very extended adoption we then ventured to predict for it. From the absence of impurities, its non-volatility even at high temperatures, great lubricating power, and freedom from gumming, this lubricant has for a long time been exclusively used both for the internal and external parts of engines in many of the large steamship lines, as well as in ironworks and other manufactories, and we now have to chronicle a still further and very important development in its application to the lubrication of the compression and expansion pistons and valves of air refrigerators.

The difficulties which beset the engineer in the selection of a suitable lubricant for these machines are of quite a novel character; for, in the first place, extremes of temperature, altogether unknown in ordinary machinery, are experienced, while, in addition, it is imperative that no material should be brought in contact with the air, which is capable of imparting to it even the slightest taint; otherwise, when it is delivered to the meat storage chamber an unpleasant flavour would speedily be acquired by the meat, thus at once impairing its marketable value.

In the early type of refrigerating machines, in which water was injected into the cylinder during compression, no further lubrication was attempted at this stage, nor indeed was it necessary; while during expansion, which is a dry process, recourse was had to copious supplies of glycerine. This, however, while answering the purpose, was, on account of the quantity used, expensive; glycerine being but a poor lubricant compared with "Engelbert's," although about the same in price. But in refrigerators, with surface cooling after compression, it becomes necessary to introduce a lubricating material to the compressor, and as the temperature of the air rises to as much as 300 deg. Fahr., notwithstanding the heat taken off by the water-jacket, it is important that this lubricant should not only be free from smell at ordinary temperatures, but that it should be non-volatile when heated, and also retain its lubricating properties at that high temperature.

During expansion the case is very different. The temperature of the air, and of course the cylinder also, falls to 50 deg. below zero Fahr., so that to be of any use here a lubricant must be incapable of being frozen or congealed with this degree of cold. It is also of the most vital importance that no smell should be given to the air at this stage, as it is delivered direct from the expansion cylinder to the meat storage chamber, and would retain any taint it received.

It is found that "Engelbert's" Lubricant acts efficiently under the conditions which obtain both in the compression and expansion cylinders, keeping its full lubricating qualities at both extremes of temperature, and being quite free from smell. It is, therefore, being adopted to the exclusion of glycerine, and is used, we understand, by both the Orient, and the Peninsular and Oriental Co's. for their air refrigerators.

We take this early opportunity of commenting on this important application of Messrs. Engelbert's preparation, as we are acquainted with the trouble and annoyance hitherto met with in the lubrication of the working parts of this class of machinery, and now that air refrigerators are receiving such attention, and are likely to become so widely employed, we feel it is desirable that it should be known at once that there need no longer be any difficulty in obtaining a cheap and efficient lubricating material.

TOWING HAWSERS.

THE months of October and November of 1881, will long be remembered by those interested in shipping, from the terrible gales which have visited us in rapid succession, accompanied with an unusual number of wrecks of large ships, some taking place comparatively close into our own shores, and nearly all being attended with serious loss of life. While the actual accident leading to the loss of the vessel cannot, in all cases, be directly traced to any remediable defect, it is only too true that some of the frightful disasters at sea are, without doubt, caused through the breakage of an ill-designed piece of machinery, of an insufficient hawser, or through the failure of a machine to work at the proper moment, and we regret to say that the two last reported serious losses—the one from the Inner Hebrides, and the other from the Coast of Northumberland, would appear to be of this latter class—we refer to the wreck of the sailing vessel *Culzean*, and the probable wreck of the hull of the new iron steamer *Claremont*, both of which occurrences have been fully detailed and commented on in the daily press during the last few days.

The *Culzean* was an iron clipper of 1572 tons register, which, early last week, was being towed round to the Clyde for repairs by the steam-tug *Conqueror* of 60 nominal horse-power. Three times had the vessels to seek shelter from the weather, but, beyond this, all went fairly well till they got as far as Jura. Here in a gale the tow rope broke, and the *Culzean* drifted hopelessly on to the rocks, where she became a total wreck, and her crew of eighteen hands perished.

The accident which occurred off the coast of Northumberland a day later, was of a somewhat similar character. The hull of the *Claremont* had been built on the Tyne, and was to be engined at Kirkcaldy, to which town it was being towed by the steam-tug *Sensation*. Meeting with stormy weather off Coquet Island, the hawser broke, and the vessel with all hands, the number of which is uncertain, was blown helplessly out to sea, and by this time is probably lost.

Apart from the question as to whether it is justifiable to send partially equipped ships in tow for long distances round a stormy coast at this season of the year, there is unfortunately no room for difference of opinion as to the immediate cause of the disaster in both of these cases. The cause was a deficiency in strength of the tow ropes, and from the extreme seriousness of these two events, which, however, are merely typical examples of what frequently happens, we are driven to enquire whether the rules given for guidance in determining the sizes of these hawsers do not need revision to meet the present condition of affairs.

Under Lloyds' rules, the *Culzean* would be provided with 90 fathoms of 11 in. hemp, or the same length of 3¼ in. steel-wire hawser, each of which would have a breaking strain *when new* of 26 tons. In very smooth water, under ordinary circumstances, the mean pull on the hawser would probably not exceed 6 tons, or about one-fourth of the breaking load; but in a storm, or even in a moderate sea, it is evident that the case is entirely changed, and that the strain on the rope might be increased, not indefinitely it is true, but to an extent controlled only by the momentum and inertia of the vessels; and it is extremely improbable that, in the present case, with a tug the size of the *Conqueror*, a factor of safety of four times would at all represent the allowance necessary to cover the increase from rolling and pitching, as indeed was proved by the result.

Again, for steam-vessels, the strengths given by Lloyds are even more out of proportion than for sailing-ships. A steamer of 2,400 tons is required to be furnished with 100 fathoms of 12-inch hemp or 4-inch steel-wire hawser, either of them being equal to a breaking strain of 33 tons *when new*. But as a steam-vessel generally requires to use her ropes in the event of a breakdown of her machinery at sea, in which case she is not towed by a light tug but by another steam-propelled vessel as powerful, or, perhaps, more powerful than herself, while the sailing-vessel is more likely to be towed in calm weather, or on entering a port or harbour, it is surely obvious that the steamer should be provided with hawsers at least double the strength of those necessary for a sailing-vessel of equal size.

Within the limits of an article such as this we can do little more than direct the attention of shipowners and engineers to these discrepancies, which, we fear, can only be rectified by the force of opinion. It is, however, most noteworthy that, among others, the Peninsular and Oriental Steam Navigation Company has already made a very considerable deviation in the direction we advocate, and is fitting its vessels with Messrs. Bullivant and Co.'s steel-wire hawsers equal to fully double the breaking-strain laid down by Lloyds' rules, but yet weighing no more than the hemp-ropes required by these rules. We hope that, after attention has been once directed to this important matter, it will not be long before the necessary change is accomplished, so as to ensure to our vessels a greater safety when being towed than at present seems to exist.

HYDRAULIC MACHINERY ON BOARD A SHIP.

FOR some time past attention has been given by mechanical engineers to improvements in the methods of loading and unloading and other work on board ocean-going steamers, and especially those which carry both passengers and freight. The *Quetta*, which sailed for Calcutta from London recently, and is the last-built of the British India Line, offers a striking example of some of these improvements. Her length is 380 ft., breadth 40 ft., depth of hold 29 ft., and gross tonnage 3,302 tons, and she is distinguished from all other vessels by a new system of hydraulic machinery applied for the first time to ocean-going steamers for the purpose of steering the ship, heaving the anchor, and taking on board and discharging the cargo. All these functions are performed by a hydraulic system ramifying throughout the ship, and worked by pumping engines of 100-horse power in the engine-room. The various pipes spreading fore and aft, and even up the masts, and serving to transmit the force originated by steam power in the centre of the vessel, might be compared to the arteries of the human frame circulating the blood pumped into them by the heart.

The machinery may generally be described as follows:—A pair of compound condensing engines of 100 indicated horse-power pump water (or in winter non-freezing fluid) from a tank into a steam accumulator. The pumping engines are started and stopped by the falling or rising of the steam piston in the accumulator; and since the piston falls when the hydraulic power is being utilized and rises to its former level when the power is not in use, it follows that the apparatus is perfectly automatic. Once started, it does not require the supervision of an engineer, and it maintains a steady pressure of 700lb. per square inch in the hydraulic mains or pressure pipes. These are carried up from the engine-room fore and aft of the ship. Alongside the pressure mains a similar return main is laid, which discharges into the tank. From the pressure mains branches are connected to the various hydraulic machines. In order to admit the pressure to anyone of these machines nothing is required except a turn with an iron key. After having done its work, the water is discharged into the return mains, being thus used over and over again.

Next may be stated in detail the ship's gear worked by this hydraulic system. At the forecastle is placed a hydraulic capstan of 15 tons power, which is driven by four pendulous hydraulic cylinders, collectively of 50-horse power, acting upon a revolving eccentric, the shaft of which is directly connected to the windlass for heaving the anchor, while the capstan above is available for warping the ship. A similar but less powerful capstan is placed at the other extreme end of the mains on the poop.

The ship is steered, not by means of the usual wheel aft, but from the bridge amidships, by a simple wooden tiller similar to that of a small yacht. A wheel, indeed, was originally added to humour the prejudices of the crew, but after the experience of a voyage, it has been stowed away as superfluous. By moving the tiller, a slide-valve is opened, which is in connexion with the hydraulic rams and cylinders aft. When the valve is opened to either port or starboard cylinder, a corresponding movement of the rams and rudder takes place, strictly controlled, however, by mechanism which prevents the helm from running away from the steersman. The rudder itself is connected with the rams in such a way that the latter obtain an increasing leverage as the rudder is being put hard over, when this leverage is, of course, most needed.

A hydraulic cylinder with a similar arrangement of valve and automatic controlling levers is applied to the marine engines, by which they can be reversed or stopped in three seconds by a single reversing lever. The water-tight door of the shaft tunnel is also opened and closed by a hydraulic cylinder, the valve of which is near the deck, so that in the event of accident this door can be instantly closed. In the stoke-hole close by is fixed a hydraulic hoist for lifting the ashes.

As has been said, however, the most valuable application of the *Quetta's* hydraulic machinery is to the loading and unloading of the cargo. Notwithstanding the great advance in speed which has been attained during the last quarter of a century by improvements in ships' build and engines, it is somewhat remarkable that the method of loading and discharging cargo speedily has received little or no attention. The prevailing arrangement for effecting this purpose has, for the last twenty-five years, been nothing more nor less than the old hand-worked winch, with its train of cog-gearing, but with two steam engines applied to dispense with manual labour. These steam-winches are placed at the different hatches, involving, in our longest steamers, a length of copper steam piping of 600ft. The disadvantages of such a system are obvious, as many can testify who have made the passage to Calcutta and who have tried to sleep in their berths under the noise and rattle of the many-cog wheels and quick-running engines working at night at the various ports on the way. In the *Quetta* not only is this noise and vibration obviated but, at the same time, a higher speed of lifting the cargo is obtained, which, of course, means a saving of labour and a quicker voyage. As an instance of this, it may be mentioned that at Colombo, in the course of the single voyage which the *Quetta* has already made to Calcutta and back, 1,250 tons of rice were discharged in 10 hours. Besides these advantages, others are obtained, such as economy of fuel by the adoption of compound pumping engines and the absence of long steam-pipes which condense the steam; and, lastly, following upon the absence of noise and friction, a great reduction of wear and tear in deck machinery.

The hydraulic lift is well known and largely adopted in docks, but has never before been successfully applied to ocean-going steamers. On the *Quetta's* deck there are four hatches. Those at the extreme ends fore and aft are fitted with single hydraulic lifts, the two main hatches having double hydraulic lifts. Each of these lifts is capable of raising a ton-and-a-half through a height of 70ft. at a speed of 5ft. per second. The lifts consist of hydraulic rams, fitted into cylinders, and working through stuffing-boxes. Each ram is connected to three chain pulleys, while the other three are carried by the cylinder base-plate. A foot of rise in the ram raises the load 6 ft. The water is admitted to the cylinder by a slide-valve worked by a single-lever, whereupon the load is lifted; while, by reversing the lever, the water is allowed to escape and the load to descend. An ingenious arrangement, which we have no space to describe, prevents the load from running from one extremity to the other, through the unskilfulness of the driver, and thus risking damage to the cargo. A wholly inexperienced man can thus work the apparatus without any danger. The hoists will discharge cargo at the highest speed of 5ft. per second and be brought to a state of rest automatically at any position required.

It is not claimed that the hydraulic system, as applied to ships' fittings, is absolutely new, but it has not before been successfully and completely applied to ocean-going steamers. The same engineer who fitted the *Quetta* applied, 12 years ago, hydraulic steering-gear and reversing-gear to the Birkenhead ferry boats. The Peninsular and Oriental Company's steamer *Poonah* was also fitted by him with hydraulic steering-gear, which, owing to the want of sufficient controlling power, was not a success. Three years ago the *Kosmos*, built by Messrs. Denny, to ply on the River Plate, was fitted by the same engineer as completely with hydraulic machinery as the *Quetta*; but, as a comparatively small river steamer, it is not to be considered on the same footing as the larger ship.

To summarize the advantages of the *Quetta's* hydraulic machinery a pair of engines in one place do, with no noise and half the consumption of fuel, the work usually performed by, perhaps, a dozen donkey engines; while about £30 or £40 a voyage is saved in wear and tear. The increase of speed obtained in loading and discharging cargo practically insures a quicker voyage. The rapidly-working machinery necessitates double gangs of men in the hold; but, though the hands are more numerous, they are paid for a shorter time; and the cost of labour per ton of cargo is thus less than usual. The prime outlay is considerably greater than under the ordinary system; but it is calculated that in at least three years the extra expense will have been saved.

The *Quetta* was built at Dumbarton, by Messrs. Denny Brothers; the hydraulic machinery was designed and carried out by Mr. Andrew B. Brown, Mem. Inst. M. E. Edin. It may be mentioned that three more ships of the British India Line are to be constructed on a similar pattern.

TORPEDO BOAT FOR THE DANISH GOVERNMENT.

MESSRS. THORNYCROFT & CO., of Chiswick, have lately completed a large torpedo boat for the Danish Government which differs in many respects from the usual type of first-class boat built by that firm, not only in her size, which is probably greater than that of any torpedo boat afloat, but in the nature and extent of her armament, and in the arrangement of the accommodation on board of her. The boat in question is 110 ft. long by 12 ft. beam, and has a displacement of 55 tons, with all her weights on board and ready for action. This displacement is far in excess of that of the English first-class boats, which amounts to only 33 tons. It may be noticed that the beam of the boat is somewhat less than is usual in the later types of torpedo boat. The reason of this is that 12 ft. is the largest beam that would allow of the boat passing under the bridges on the Danish railways, the intention of the Danish Government being to carry all boats of this class on specially designed trucks from one part of the coast to another, so that, although an enemy might know the exact number of torpedo boats possessed by the Danes, he could not know their whereabouts, and might be attacked from any part of the coast.

Her armament consists of four Whitehead torpedoes of the largest size—viz., 19 ft. in length by 15 in. diameter, which will be ejected through two discharging tubes of the Whitehead pattern fixed in her bows. In this type of ejecting apparatus the torpedo itself takes the place of the piston in the usual impulse gear, and the air, at a pressure of about 1½ atmospheres, is admitted behind the torpedo, which it ejects at a speed of something like 30 knots per hour. When the boat is ready for action, two of these torpedoes will be carried in the ejecting tubes and two in the loading shoots in the torpedo room immediately to the rear of the tubes. After the first two are discharged, the second two can be put in the tubes without the men exposing themselves by coming on deck. In both these respects the Danish boat differs from the English first-class boats, which only carry three torpedoes of the smaller size—viz., 14 ft. in length by 14 in. diameter, and carry one of them partially protected in the revolving ejecting tube on the forward deck, and the remaining two entirely exposed in transporting carriages amidships. The English boats have the advantage of being able to discharge their torpedoes on the broadside while passing an enemy at full speed, while the Danish boat will have to come up bows on. The target, however, exposed to the fire of the Nordenfelt and other machine guns will be much greater in the case of the English boats than of the Danish. The charge in the 19 ft. torpedoes of the Danish boat is 80 lb. of gun-cotton, and they are capable of going a distance of 1,000 yards at a speed of from 18 to 19 knots. On the top of the conning-tower is fixed a Hotchkiss revolving cannon of 1½ in. diameter of bore.

The hull is made of steel plates and angle bars, carefully galvanized throughout, and is divided, as is usual in boats of Messrs. Thornycroft's construction, into a large number of compartments by means of bulkheads and half bulkheads. All these compartments may be drained on ordinary occasions by means of sluice-valves into a large tank in the boiler-room, from which the water is pumped overboard by means of the bilge-pumps in the engine-room. But to provide for extraordinary leakages, five large steam ejectors, each capable of discharging 20 tons of water per hour, are disposed in the various parts of the vessel, so that on a leak occurring in any compartment the steam may be at once turned on by the men stationed in that compartment, and the leakage kept down while the hole is being plugged to allow of the complete ejection of the water.

The engines are of the usual compound condensing type, the sides and ends of the cylinders being carefully steam jacketed and lagged, so as to insure the utmost economy in the working of the engines, one of the conditions of the contract being that the boat should carry sufficient coal to run a distance of 1,000 miles at a speed of about 10 knots. The boiler is of the locomotive type and is fitted with appliances for protecting the stokers in the event of a tube bursting, and for at once extinguishing the fire in case of necessity. The coal bunkers are capable of holding 10 tons of coal, which quantity was found sufficient on trial to propel the boat 1,200 miles at a speed of 11 knots.

The speed trials previous to the reception of the vessel took place on the Thames on October 29th, the Danish Government being represented by Captain Johnke, Chief of the Danish Naval Torpedo Service; Captain Neilsen, Chief Constructor of the Danish Navy; Lieutenant Rasmussen, Assistant Constructor to the Danish Navy, and other officers. The contractors were represented by Mr. John Donaldson, assisted by Mr. Barnaby and Mr. Brown. Captain Eckermann, Chief of the Swedish Torpedo Service, was also on board during the trial.

The trial stipulated for in the contract was that the boat should attain a speed of 18 knots on a run of three hours' duration, with a load of 12½ tons on board, to represent the armament and stores when ready for service, and this speed was to be ascertained by running the boat for three hours and taking the number of revolutions of the engines for that period, and subsequently by running her six times over the measured mile with half the quantity of coal necessary for the three hours' run deducted from the 12½ tons, so that the boat on the mile runs might, in regard to weight, be in the average condition she would be in during the three hours' run. But as this involved the necessity of running the boat on two separate days, and as it was considered desirable to complete the trials in one day, the expedient of taking three runs on the measured mile before the three hours' run, and three runs afterwards, was adopted.

The mean speed during the first three runs was found to be 20·366 knots, and on the second three runs 21·127 knots, giving a mean speed of 20·746 knots. The number of revolutions required to do a knot in still water was found to be 1,175, and the total number of revolutions during the three hours' run 70,195, which gives a speed of 19·91 knots, or practically 20 knots per hour—that is to say, two knots above the contract speed—a result which was considered highly satisfactory by all parties concerned.

NEW TORPEDO BOATS AND GUNS.—An interesting trial of a new torpedo vessel, the invention of Mr. John Ericsson, took place in New York Harbour on November 11th. The boat is 135 ft. long, 11 ft. deep, and 12 ft. wide. It is strongly armoured, of 1,000 horse-power, and has realized a speed of 16 knots. Its gun rests on the keelson, with the muzzle submerged six feet, and discharges the projectile directly into the water. In previous experiments a charge of 12 lbs. of coarse powder was used to discharge a dummy torpedo, which was projected a distance of 600 yards. In actual warfare the explosive charge is intended to be 340 lbs. of dynamite. Mr. Ericsson states he has made 52 trials of the weapon, each one of which has proved successful. He claims especial merit for it on the ground of its being easily managed, immediately repaired if damaged in action, and also for the accuracy with which the projectile travels towards a given object. At the same time a model of the Lyman Haskell Accelerating Multi-charge Gun was exhibited. Its novelty consists in having four charges disposed in chambers at intervals along the bore, these being successively ignited as the shot passes along the barrel, with the result that the velocity is enormously increased. A 10-inch Haskell is supposed to be equal in destructive effect to an 80-ton Armstrong gun.

TORPEDO BOATS.—The two improved first-class torpedo boats which Messrs. Yarrow & Co. lately built for the Argentine Government reached Buenos Ayres in perfect safety. These were rigged for sailing, and were found to answer very well under canvas. One was navigated direct from London across the Atlantic without being accompanied by any convoy, while the other steamed first to Fiume to have her torpedo gear fitted on board at Mr. Whitehead's works. This is the first occasion on which a torpedo boat has crossed the Atlantic, the result proving that craft of the kind can be built combining exceptional speed and rapidity of movement with thorough seaworthiness and capability of steaming long distances. The two Austrian boats completed by the same firm, which, it may be remembered, realized a speed of 22 knots, have successfully steamed from Poplar to Pola. Messrs. Yarrow have also despatched ten of the same class of torpedo boats, known as the "Batoum" class, to the Mediterranean without their being indebted to anything but their own resources, thereby proving that they can be navigated long distances in case of need. The firm are at present engaged in building similar boats for the Dutch, Italian, Portuguese, Argentine and Brazilian Governments.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 20th October to 20th November, 1881.

4605 J. Tinker and others. Steam boilers.
4625 G. W. Clarke. Steam boiler furnaces.
4629 J. G. Stidder. Gland stuffing boxes.
4633 R. B. N. H. J. Duncan. Davits and disengaging apparatus.
4647 J. R. Oswald. Construction of twin screw ships.
4651 F. Lebacq. Suspension for beds, &c., to prevent sea sickness.
4652 W. R. Lake (communicated by D. Parks). Ships' sleeping berths.
4672 F. H. Ward. Steam pumps.
4674 P. Y. P. Dawbarn. Steam boilers and superheating.
4676 J. Hodson. Wire ropes.
4693 J. Woodward. Elevator for grain, coal, &c.
4700 S. Geoghegan & J. Sturgeon. Steam engines.
4708 J. M. Leishman (communicated by E. Consteau). Screw propellers.
4721 W. G. Herbert. Loading ships.
4729 A. M. Clark (communicated by R. H. Earle). Lowering and raising ships' boats.
4745 R. T. Gillibrand. Water heating, steam generation, and smoke consumption.
4755 F. H. F. Engel (communicated by A. S. and A. Aggens). Anchors.
4773 A. W. Cooper. Hand and steam-steering apparatus.
4783 G. Hepburn and W. Parker. Navigable ships and vessels.
4784 W. Cook & D. Mylchreest. Ships' rudders.
4797 P. L. Gore. Electrical cables.
4798 G. Kamensky (communicated by D. Novekoff). Tubular boilers.
4803 W. Cooke & D. Mylchreest. Ships' keels, stems, sternposts, and screw frames.
4807 W. R. Kinipple. Ships' construction and propulsion.
4809 R. S. Boyer. Compound marine and stationary engines.
4810 L. Masche. Non-conducting coating.
4814 N. Macbeth. Steam-engines.
4830 W. R. Lake (communicated by J. L. Lay). Boats and electrical controlling apparatus.
4836 Lieut.-Col. the Hon. W. E. Fitzmaurice. Prevention and extinction of fire.
4838 W. R. Kinipple. Light vessels and propulsion of wheeled vehicles.
4856 W. R. Lake (communicated by J. H. Porter). Ships' berths.
4868 J. Dickie. Ships.
4875 J. Adams. Feed water supply.
4898 A. M. Clark (communicated by W. B. Furman). Balanced slide valve.
4902 J. F. Smith. Bridges and aqueducts.
4904 E. P. Alexander (communicated by J Elliott). Smoke consumption and fuel economy.
4912 S. Pitt (communicated by W. H. Mallory). Torpedoes.
4913 S. Pitt (communicated by W. H. Mallory). Propelling and steering.
4918 J. Standfield & J. L. Clark. Wreck-raising and submarine boring and cutting apparatus, &c.
4920 J. T. Baharie & W. Adamson. Life boats.
4957 J. Gwynne. Ships' pump valves.
4975 J. Shanks & J. G. Lyon. Steam-engines.
4977 G. Knowling. Steering apparatus.
4995 C. E. Kelway & F. Dyer. Speed recorder for vessels or currents.
4997 T. Allison & G. Senior. Lubricator.
5019 H. F. Philips. High speed vessels.
5025 H. Garland. Elevators for grain, &c.
5061 H. J. Coles. Steam-engines.

⁂ Any information regarding these or other patents will be gladly furnished on application.

BOARD OF TRADE EXAMINATIONS.

Return of Engineers reported to have passed examination under the provisions of the Merchant Shipping Act, 1854, during the month.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

October 29th, 1881.

Addington, Wm.	1 C	Lvrpool.
Bush, William ...	2 C	do.
Collard, John A.	2 C	do.
Cross, George ...	2 C	Glasgow.
Dove, John ...	2 C	London.
Elder, Thomas	1 C	Glasgow.
Hay, James ...	1 C	do.
Hanley, Thos. H.	2 C	Lvrpool.
Hammond, Charles P. ...	2 C	London.
O'Sullivan, Richd.	2 C	Cork.
McDonald, Hugh S.	2 C	Glasgw.
McLean, Archibald	1 C	do.
Steward, James ...	1 C	do.
Walker, David ...	2 C	do.
Williamson, James	1 C	do.

November 5th, 1881.

Arnison, Thomas William ...	2 C	N Shlds.
Bardsley, William	2 C	Lvrpool.
Bickerton, Richard	2 C	N Shlds.
Bissett, Thomas	1 C	London.
Briggs, William	2 C	Sndrlnd.
Burgess, Wm. N.	2 C	Lvrpool.
Cameron, John ...	1 C	London.
Cunningham, Jas.	2 C	do.
Davey, William	2 C	Lvrpool.
Edwards, Jas. R.	2 C	N Shlds.
Goding, James ...	2 C	do.
Grossman, Adam	2 C	London.
Gerry, Samuel ...	1 C	Bristol.
Henderson, Wm.	1 C	Sndrlnd.
Hodgert, Robert	1 C	Grnock.
Hodgson, Jno. A.	1 C	do.
Ireland, William	1 C	Bristol.
Landeman, John	2 C	N Shlds.
Laing, Thos. D.	1 C	Sndrlnd.
Mahany, Robert	2 C	London.
Matthews, Thomas F. ...	2 C	Lvrpool.
McDonald, Duncan ...	2 C	do.
McGarrow, Chas.	1 C	Sndrlnd.
Milward, John Charles ...	1 C	Bristol.
Owen, Huge ...	2 C	Lvrpool.
Page, J. Page ...	2 C	Sndrlnd.
Peck, Wm. W.	2 C	Lvrpool.
Piggs, F. ...	2 C	Sndrlnd.
Reid, John ...	1 C	do.
Rindfleisch, I. ...	1 C	N Shlds.
Rugeroni, E. ...	1 C	London.
Sherwood, Thos. J.	1 C	Sndrlnd.
Singleton, Thos.	1 C	N Shlds.
Swinson, Henry	2 C	Sndrlnd.
Taylor, J. K. ...	2 C	do.
Thomas, Henry	1 C	do.
Walker, John ...	1 C	Lvrpool.
Webster, Andrew	2 C	Grnock.
Wilson, Archibald	2 C	N Shlds.
Wright William	1 C	do.

November 12th, 1881.

Aiken, Jno. Wm.	2 C	Cardiff.
Beattie, Henry...	2 C	Leith.
Downie, Alex. ...	2 C	Lvrpool.
Elmsley, James Cochrane ...	1 C	do.
Liddell, James ...	2 C	Leith.
McRobbie, Jas. Robert	2 C	Lvrpool.
Pattinson, Jos. ...	2 C	do.
Roberts, Robert	2 C	do.
Rosser, William David	2 C	Cardiff
Scanes, Walter...	1 C	London.
Snelling, John ...	2 C	Cardiff.

November 19th, 1881.

Anderson, James	1 C	London.
Balfour, Murray	1 C	Glasgow.
Britton, William	1 C	do.
Brock, James ...	2 C	do.
Campbell, Duncan	2 C	do.
Carruthers, Jas. J.	2 C	Lvrpool.
Clunie, George Hunter ...	2 C	Glasgow.
Cook, John ...	2 C	do.
Crawford, Thos.	2 C	Lvrpool.
Eskdale, John ...	1 C	N Shlds.
Ewen, Thomas...	1 C	do.
Graham Alex. ...	1 C	Glasgow.
Greenhorne, Archibald ...	1 C	do.
Hardy, Jno. Robt.	1 C	N Shlds.
Harrison, Samuel	1 C	Lvrpool.
Hall, James ...	2 C	N Shlds.
Highett, Robert	1 C	Glasgow.
Hutchinson, Jos.	1 C	N Shlds.
Jones, David Wm.	1 C	Glasgow.
Lambert, William	1 C	N Shlds.
McCulloch, Wm.	2 C	Glasgow.
Morrison, Donald	1 C	do.
Parlane, Peter E.	1 C	do.
Pearson, Thomas	1 C	N Shlds.
Roberts, Henry Owen	1 C	Lvrpool.
Rousell, Thomas	1 C	do.
Scott, R. Carr ...	1 C	N Shlds.
Shields, Richard	2 C	do.
Sim, John M. ...	2 C	Glasgow.
Spence, Robert..	1 C	Dublin
Taylor, James ...	2 C	Glasgow.
Thompson, Robt.	2 C	N Shlds.
Wallis, Jno. Wm.	2 C	Plymouth
Wilson, John ...	1 C	Glasgow

ROBERT JACKSON, Registrar-General.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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The Marine Engineer.

LONDON, JANUARY 2, 1882.

EDITORIAL NOTES.

NEW competitors to England, in the shipping carrying trade, have suddenly appeared. Of all people in the world it is the Chinese who are thus daring to rival the mistress of the seas in her commercial pursuits. The steamer *Meifoo* has just arrived in the Thames from Shanghai, and is the first of a regular line of steamers under the Chinese flag. It is proposed in China to establish a regular line of steamers between London and China, to carry on a direct import and export trade. The proposed association will commence with a capital of £150,000, and will include as members, some of the highest and wealthiest Chinese capitalists and merchants. The Association is to be under Chinese management, and two managers Lun-shi-ting and Laing-sing-un came over in the *Meifoo* as passengers. They propose to establish their head-quarters in London, and they hope to do a thriving trade. The *Meifoo* brought over a cargo of tea, and is said to be the first vessel under a Chinese flag to deliver cargo in the London Docks. The *Meifoo* was formerly the iron barque *Benclutha,* which was stranded on the Shantung promontory, but was afterwards got off in 1879.

ENGLISH ship-owners, however, do not seem to be relaxing in their efforts to keep pace with any amount of carrying demand that may be made upon them. The Clyde building trade continues to be brisker than was ever known before, and the annual turn out for this year promises to be at least 50,000 tons in excess of the year 1874, which had been hitherto the largest known. 32,366 tons were launched in the month of November, the largest monthly output ever known, nor do the orders in hand exhibit any flagging tendency for the new year. Amongst many new contracts placed with the Clyde builders, we may mention five new steamers ordered for Messrs. Donald Currie & Co.'s "Castle Line" to the Cape. Three of them are to be of fully 4,000 tons each, and the other two of about 3,000 tons. Messrs. Money Wigram & Sons, Limited, have also arranged for the building on the Clyde and on the Tees of three steamers of about 4,000 tons each for their Australian service. All this points out without a shadow of doubt that we are at last through the dull days, and entering another decade of prosperity which promises as each former wave has done, to still surpass in the maximum of trade and national prosperity that it will reach any former cycle of inflation This will prove a triumphant reply to the dismal augurs of England's decadence which have been latterly so prevalent.

WE have every sympathy with Admiral J. E. Commerell in his endeavour to impress the importance of a jury rudder being carried as a complement to all mercantile vessels and to men of war. Our Government Boards are proverbially hard to move, but we are surprised that not more attention has been paid to such a subject by the many enterprising owners of ocean steamers. It is well known that nothing is a more sure cause of foundering at sea than the loss of steering power. If we may judge by analogy from the number of vessels that creep into port more or less damaged about their steering gear, there must be many vessels lost in mid ocean from this cause that are never heard of. The *Bacchante*, some little time ago, was in a situation of much danger, and was unavoidably separated from her squadron through an accident to her steering gear. The very modern improvements of steam steering gear, and complex mechanical fittings, will all serve to render the chances of fouling and accident more numerous. The very material, iron, in which our ships are now mostly built serves to render any temporary repairs more difficult and impossible of execution without docking and special appliances. We think it would be an exceedingly easy matter to provide for any contingencies of fouling or breaking to the steering gear under the two following heads:—First, that on any rudder being fouled it should be arranged so as readily to unship and be either hoisted on board or got rid of. And, second, that each vessel should be provided with special appliances to enable a jury rudder to be promptly shipped, capable of taking the ship into port.

WE seem to be as far off as ever in the matter of a suitable armament for our Navy. Nearly twelve months ago some distinct statements were made in Parliament as to new guns being in preparation for the Navy on the breechloading system. We have heard nothing, however, as yet as to any trials of their efficiency, and of course it would, or ought to be, impossible for the Admiralty to accept such new guns from the War Department without such thorough test. We are inclined to believe that there is some hitch about them. As it is generally understood that the famous 43-ton gun, with which Woolich was to astonish the world, has not created the stir expected of it, and was thus something of a failure, so it is easy to imagine that Woolwich has again failed as gun manufacturers. It is notorious that Italy is having most powerful and satisfactory weapons manufactured by private firms in England, and it is thus absurd for us, as taxpayers, to see the finest ordnance made on our own shores for foreign governments, whilst our own War Department is still bungling about in the difficulties of experiment and failure.

THE submarine telegraph companies are powerfully agitating, with very good cause, to obtain international protection for their cables. The evident interest of all parties owning shipping property would in itself have appeared sufficient to have deterred any of their servants from carelessly damaging any submarine cable. Many of the accidents, however, arise from the careless anchoring of vessels too near to the line of cable, or from the fouling of repairing vessels by ships or steamers allowing their course to run unnecessarily close to them. In the case of individual fishermen, too, who wilfully cast their nets across cables or allow themselves and their nets to float foul of repairing vessels, their seems no other means of restriction except by police measures. The companies thus hope to get international police regulations carried into effect against those wilfully damaging cables or buoys used whilst repairing the same. We think it probable that this very reasonable request will be granted, and we shall hope to see it bear fruit it in the less frequent disturbance of the means of telegraphic communication, which has now become so important to all commercial industries.

SHIPBUILDING ON THE CLYDE.—The year 1881 has been one of remarkable activity in the shipbuilding industry of the Clyde. Altogether 261 vessels have been launched, with an aggregate measurement of 341,022 tons. Last year, which showed the largest total of any year except 1874, the tonnage reached 248,000, or about 90,000 under the present figures; and the returns for 1874 are exceeded by between 70,000 and 80,000 tons. Notwithstanding this large output the prospects are of the brightest description, as it is understood shipbuilders have a larger number of contracts on hand than they had at the beginning of the present year, while several yards which have been closed for some years are about to be reoccupied. An analysis of returns supplied by the various builders shows that there has been a large and general increase in the size of the vessels launched. This, indeed, is the chief feature of the year's work. An unprecedentedly large number of the vessels launched have been built of steel. In 1879 the figures for steel work were 18,000; in 1880, 42,000; and this year, 66,609 tons; and it is worthy of note that a number of the largest vessels have been constructed of the new material. The increase is pretty fairly spread over all the Clyde firms. Messrs. J. & G. Thomson head the list with 27,100 tons, and Messrs. John Elder & Co. come next with 26,575 tons. The following is a general abstract of the number of vessels completed during the year 1881:—J. & G. Thomson, 7 vessels; John Elder & Co., 9; A. Stephen & Sons, 10; Dobie & Co., 7; Wm. Dennie & Bros., 8; London and Glasgow Shipbuilding Co., 7; Russel & Co., 11; A. M'Millan & Sons, 6; Barclay, Curle & Co., 9; Caird & Co., 4; Chas. Connell & Co., 5; A. & J. Inglis, 6; D. & W. Henderson & Co., 6; Lobnitz & Co., 8; H. M'Intyre & Co., 14; James Steel & Co., 12; Robert Napier & Sons, 3; Robert Duncan & Co., 14; Aitken & Mansel, 4; Cunliffe & Dunlop, 14; John Reid & Co., 7, Robert Steele & Co., 5; Wm. Simons & Co., 6; H. Murray & Co., 7; Murdoch & Murray, 6; Blackwood & Gordon, 12; Napier, Shanks & Bell, 4; The Campbeltown Company, 5; Robert Chalmers, jun., 2; Wm. Hamilton & Co., 1; Wm. Burrell & Co., 1; John Fullarton & Co., 4; Campbell & Co., 4; T. B. Seath & Co., 10; Hanna, Donald & Wilson, 11; Barr & Shearer, 2; Scott & Co., Bowling, 3; Wm. Fyfe, Fairlie, 5; J. Macadam, 2—total 261. For the sake of comparison, we subjoin the tonnage launched on the river for the past 23 years:—

Year.	Tonnage.
1881	341,022
1880	248,656
1879	174,780
1878	222,353
1877	169,710
1876	174,824
1875	211,824
1874	262,430
1873	232,926
1872	230,347
1871	196,229
1870	180,401
1869	192,310
1868	169,571
1867	108,024
1866	124,513
1865	153,932
1864	178,505
1863	123,262
1862	69,967
1861	66,801
1860	47,833
1859	35,709

AN IMPROVED METHOD OF STOWING AND DISCHARGING TORPEDOES FROM TORPEDO BOATS OR OTHER VESSELS.

THE idea of an offensive attack by means of a boat specially constructed to carry an explosive machine, which would severely damage and probably wreck the vessel attacked, has existed for more than a century.

This was in the first instance an American invention, brought out by Captain David Bushnell, of Connecticut, in 1775. His boat held only one person, and contained an air-tight chamber, with a sufficient quantity of air to support him for thirty minutes. Beneath this chamber was a water-tight chamber, fitted with means of letting in water or pumping out again, by the appliance of a force pump, for the purpose of sinking or raising the vessel at will. When at a proper depth below the surface, the boat was propelled under the bottom of the vessel to be attacked by an oar led to air chamber, and by means of forcing, with an arrangement also from the air chamber, a screw into the bottom of the vessel, a torpedo regulated by clockwork would be left attached. In 1801, various experiments were made at Brest for the French Government, by the celebrated Fulton, the boat he used being a diving one, propelled by a scull worked by hand-gearing. He made many useful experiments, and at one time blew up a small vessel. His plans and ideas were laid before our Government in 1804, but were cast aside as impracticable. Fulton, in the course of his experiments, developed the idea of the torpedo launch of the present day. He made a model of a 300 ton wooden vessel to have sides 6 ft. thick, for the purpose of rendering them cannon proof, and decks 6 ft. thick, which were to be musket proof. She was to be propelled by hand by a scull-wheel, and to travel at a speed then considered a high one.

The torpedoes were fixed on the ends of spars 56 ft. long, stayed by guys from the mast-head. From Fulton's time till the Crimean war, the torpedo question stood comparatively still; then, however, it only revived partially in the shape of stationary torpedoes or submarine mines, which were employed by the Russians for the defence of Sebastopol and Cronstadt.

Again during the Civil war in America, torpedo boats were resorted to, and some vessels were blown up by their means. At the same time, for want of proper arrangement and management, they were in some instances, blown up as well as the vessel they attacked. At the close of the war, both sides were busy in preparing special spar torpedo boats. Since then, vast strides have been made towards perfecting the efficiency of the torpedo boat in the most destructive method of attack. To carry this out, the speed of torpedo boats has increased from time to time to nearly double that to be obtained from them a few years ago. Owing to the immensely increased destructive power of naval guns since the time of Fulton, the idea of building small vessels shot-proof has been abandoned; the torpedo boat of the present day, trusting to her speed and the small mark she shows as a target, to escape scatheless. Fulton's idea of the method of attack by means of spar torpedos still meets with a certain amount of favour and attention. At the same time, various other methods of stowing and discharging torpedos, have been proposed or tried with varying success.

In perfecting the stowage and discharge of torpedos, many things have to be considered. Torpedos are bulky and heavy machines to move about in the confined limits of a steam launch, weighing as they do, from ¾ of a ton to a ton each. On this account they should be stowed as near the point of discharge as possible. At the same time, the point of discharge with the arrangements for discharging should be hidden from the view of the enemy, together with the knowledge of the direction in which the torpedo is aimed.

Again, as the torpedos at present in use are supposed to strike an armour-clad below her armour-belt, the aim in discharging is to drive it on an object six or seven feet below the surface of the water. To accomplish this, various methods have been tried to supersede the spar system.

In some instances, torpedos are discharged from guns or tubes carried on the deck of the boat. Although accurate aim may be taken, the torpedo in entering the water generally meets with obstacles which prevents it from reaching its intended mark. The side crest of a wave will sometimes catch the point of the torpedo as it is breaking the surface, and throw it entirely out of the course it is intended to take. The small angle of entrance of the torpedo obtainable from the deck of a launch when discharged from these tubes, frequently causes the missile to skim on the surface, by which course it wastes its force on the thickest portion of the armour-belt of a man-of-war.

Another method in use, is that for discharging torpedoes from channels cut at an angle to the deck, and running down by the side of the stem. By this method the torpedo is discharged under the surface of the water, but this is done at an angle which would necessitate the launch being very near the vessel to be attacked; at the same time, the operations for discharging must be carried on in the full view of the enemy. Other complicated arrangements have been made for discharging torpedoes through holes or tubes through the bow of larger vessels, as well as ordinary torpedo launches, but a lot of time and manipulation is necessary to effect a discharge.

The Figs. on our illustrated sheet, show a design by Mr. J. E. Atkinson, Member of the Institution of Naval Architects, specially prepared to meet all the points set forth in a most simple and highly practicable manner.

The chief feature of the design, will be seen to consist of a trunk or well space through the middle of the torpedo boat situated at the fore side of the boiler space, and far enough from the bow to escape being injured by a collision. At the bottom of the well, a discharging trunk is fitted, capable of being momentarily placed in an oblique position, enabling the torpedo to be discharged in a direct line with the keel either forward or aft. The torpedoes to the number of 3, 4, 5 or 6, according to the depth of the boat, may be stowed one above the other, on hinged brackets in the trunk or well, and lowered in position for discharging in rapid succession. All observations are taken from the small conning tower at the fore end of the trunk or well from the crew space on the deck below, and every arrangement for discharging either ahead or astern can be made without the slightest sign that any such operation is in course of preparation, as not a single hand is required on deck.

Fig. 1 shows a longitudinal section of the well with the torpedoes (*a*, *a*, *a*) stowed, and the discharging trunk (*b*,) closed. The points (*c*, *c*,) are those on which the discharge trunk (*b*) is pivoted, these can be fixed or thrown out of gear at each end as required, at will, admitting of the trunk being lowered by means of the gearing (*d*, *d*) rapidly into the required oblique position either for a forward or after discharge. At the fore end of crew space, there is a water-tight collision bulkhead, *e*; this crew space occupies not only the space at the fore end of the trunk or well, but the wings or side-spaces as far aft as the boiler-room bulkhead.

The tubes (*f*, *f*) at each end of the trunk or well, are impulse tubes, through which pressure is brought on the torpedo by steam or air, to give it the necessary impetus for an effective discharge, and (*g*) is the conning tower, from which all observations are taken under cover.

Fig 2 shows longitudinal section of well, with the discharging trunk lowered for firing the torpedo ahead; the dotted lines show the discharging trunk lowered for firing the torpedo astern. Fig 3 shows a cross section through the well with the carrier (*h*) in position after lowering torpedo into discharging trunk. The dotted lines show the carrier raised for lowering the other torpedoes when required. The lid (*i*) is arranged to close tight whilst the torpedo is being discharged, and raised again, as in Fig 4, when the trunk is replaced after discharging, so as to admit of placing another torpedo in position.

In Fig 4 the hinged brackets (*k*, *k*) are shown; these support the torpedoes in position till they are required for use, when they are lifted by means of an attachment from the framework (*l*) the hinged brackets (*k*, *k*) are then swung aside, and the torpedo placed on the carrier (*h*) to be lowered in position for discharging. Figs 5 and 6 show the torpedo boat discharging ahead and astern respectively, and the chief divisions of after cabin, engine and boiler space, and crew space. The discharging trunk (*b*) fits the form of the bottom of the boat perfectly when in place, and thus keeps up the continuity of force and speed. The arrangements and provisions made in this design will be seen to meet more or less the requirements set forth to perfect the working of torpedoes. This arrangement of a trunk or well system could be applied to vessels of any class or size and placed not only to discharge in a fore and aft direction but also athwartships, in case of the beam of the vessel admitting of such an arrangement. In a larger class of torpedo boat, wells could be placed fore and aft, one for firing torpedoes ahead, and the other astern. It will also be a highly practicable proceeding to fit a trunk or well of this kind loaded with torpedoes in coal barges, provision boats, or any other unlikely looking engine of destruction, by means of which the greatest damage could be inflicted on one or more vessels in the most unsuspected manner. Considering the simple and perfect arrangement of mechanism used in this system of discharging torpedoes, the direct line of fire they obtain by being discharged under the keel of the attacking vessel; the advantage thus gained by obviating the disturbing influences experienced in breaking their course through the surface of the water, and the compact manner in which they are stowed immediately in the position required for discharging, this design is worth the greatest attention of all Governments interested in the destructive science of submarine warfare, and will doubtless in the immediate future become a subject of experiment and adoption by the various competing marine navies of our own and foreign countries.

SHIPBUILDING IN THE TEES DISTRICT.—During the past year Messrs. Raylton Dixon & Co., of Cleveland Dockyard, Middlesbrough, have launched 13 vessels, having a total tonnage of 25,036 tons. Their names are as follows:—Bothwell Castle, Juliet, Angier Head, Iron Acton, Uppingham, Lesseps, Popenjoy, Afrikaan, Chancellor, Jacob Christensen, Minard Castle, Zuid Holland, and Chittagong.

WEAR SHIPBUILDING RETURNS.—The following is a return of the ships built by Mr. James Laing and the Sunderland Shipbuilding Company during the present year. Mr. James Laing's list is:—Serpho, Ville de Lisbonne, Moscow, Oliveto, Congo, Charrington, Rhodora, City of Hamburg, and Laju; total tonnage, 19,413 tons. But for the late strike other two vessels, of the aggregate gross tonnage of about 7,000, would have been launched. The Sunderland Shipbuilding Company launched the Cascapedia, Hermann, Chateau Leoville, Harbinger, Bussorah; total tonnage, 13,000,

AN ACCOUNT OF EXPERIMENTS MADE BY A BOARD OF UNITED STATES NAVAL ENGINEERS WITH SCREW PROPELLERS OF DIFFERENT MATERIAL AND DIMENSIONS APPLIED TO THE UNITED STATES FISH COMMISSION'S STEAMER "LOOKOUT" WITH THE HULL COPPERED AND NOT COPPERED.

By Chief Engineer ISHERWOOD, U.S. Navy.

From the Journal of the Franklin Institute.

(*Continued from page* 196.)

SCREW *A* applied to the uncoppered vessel, and screw *F* applied to the coppered vessel, having very nearly the same diameter and fraction used of the pitch, but pitches of respectively 8·4 and 9·0 feet gave the same utilizations when that of screw *A* is corrected for the greater resistance of the uncoppered vessel, showing the difference of the pitches not to have affected the economic results. The utilizations of screws *A* and *F*, when equated for the resistance of the coppered vessel, are 66·8 per centum of the net power developed by the engine, consequently these two screws of $4\frac{2}{3}$ ft. diameter are

$\left(\frac{71{\cdot}3117-66{\cdot}8000\times 100}{71{\cdot}3117}=\right)$ 6·3267 per centum inferior to the four screws *B*, *C*, *D*, and *E* of 5 ft. diameter, the pitches and fractions used of the pitch of the former lying within the limits of those of the latter. This inferiority is caused wholly by the smaller diameter, whereby the loss of useful effect, due to the greater slip resulting from the less acting surface of screws *A* and *F*, more than counterbalances the gain due to the less resistance of the water to the less acting surface of those screws. The utilizations of screws *A* and *F* could doubtless have been much increased had the fraction used of their pitch been increased from about one-third, which it was, to one-half; or, had their pitch been decreased, retaining the same fraction of pitch.

The quantities on line 24 of Table No. 2, shows relatively the utilizations of the different screws, when the comparison is made directly by dividing the cubes of the speeds (line 2) by the net horse-power developed by the engine (line 15). The quantities on line 24 are the quotients of such divisions, and have very nearly the same proportions to each other as the quantities on line 23—considering the experiments with the uncoppered vessel separately from those with the vessel coppered—as appears from the quantities on line 25, which are the quotients of the division of those on line 23 by those on line 24. The equality of the latter quotients proves, 1st, that the distribution of the power in the different experiments, as given in Table 2, lines 13 to 23, both inclusive, is correct; and 2nd, that no difference in the utilizations results from the difference in the metals, cast-iron and cast brass, of which the screws were made. The only difference that could have resulted would have been due to the different surface textures of these two metals, whereby the resistance of the water per unit of their surface might have been different.

These experiments show what many others have shown when properly interpreted—that the utilizations of screws of different proportions of diameter, pitch and fractions used of the pitch, and of different outlines and inclinations of the blades applied to the same vessel, vary very little unless extreme variations of dimensions are resorted to. The outline and inclination of the blades appear to be absolutely without effect upon the utilization, which is controlled entirely by the diameter, pitch and fraction used of the pitch.

The experiments show also that the method of distributing the indicated horse-power developed by the engine, originally devised and long practised by the writer, is correct, and that by its means the important question of the resistance in pounds of the hull, *per se*, of a vessel at a given speed may be ascertained indirectly quite as accurately as by the direct application of a dynamometer.

The true performance and distribution of the power of the *Lookout* with her bottom coppered, when propelled by screw *E*, deduced from all the experiments, is as follows for the speed of 10 geographical miles per hour, the slip of the screw being 16 per centum of its axial velocity (product of revolutions and pitch); the number of its revolutions, 134·1711 per minute; the indicated pressure on the piston of the large cylinder, 23·4175 pounds per square inch, that cylinder being supposed to be used alone; the thrust of the screw or resistance of the hull, 1631·28 pounds, as herein determined; the indicated horses-power developed by the engine, 79·5393, and the pressure required to work the engine, *per se*, 2·7164 pounds per square inch of the piston of the large cylinder alone.

DISTRIBUTION OF THE POWER.

	Horse-power.		Per cent. of net horse-power.
Indicated power developed by the engine .	79·5393		
Power expended in working the engine, *per se*	9·2265		
Net power applied to the crank-pin . .	70·3128	or	100·0000
Power absorbed by the friction of the load	5·2734	,,	7·5000
Power expended in overcoming the resistance of the water to the surface of the screw blades	5·3474	,,	7·6051
Power expended in the slip of the screw , .	9·5507	,,	13·5832
Power expended in the propulsion of the vessel	50·1413	,,	71·3117
Totals	70·3128	or	100·0000

CHARGE AGAINST THE CHIEF ENGINEER OF A WILSON LINER.

AT the Hull Police Court, Mr. Twiss had before him the case of S. Crawford, chief engineer of Messrs. Thomas Wilson, Sons, & Co.'s steamer *Rinaldo*, who was summoned by Captain Wm. Newman, master of the same vessel, for wilful disobedience to orders.—Mr. T. W. Hearfield appeared for the complainant, and, in opening the case, he stated that the defendant had sailed with the complainant for some time, and had always conducted himself with propriety until the last voyage or two. He appeared to have got the impression that, as chief engineer, he had the control over his part of the ship, and that he was not under the direction of the master. The present proceedings were therefore instituted to show that the master had the control of the vessel, and that it was the duty of all the crew to conform to his orders.—Dr. Rollit: We don't dispute that. We say that the master may give all the orders he thinks proper, but that we cannot carry out impossibilities.—Mr. Hearfield, continuing, stated that when the vessel was last at Cronstadt the cargo was being discharged, and it was found that there was not sufficient steam on the donkey boiler. The expeditious discharge of the cargo was thereby impeded, fewer labourers having to be employed. The master was informed of this, and about two o'clock in the afternoon he instructed defendant to get steam on the main boiler, so that more hands might be put on, and the work of discharging expedited. The chief engineer replied that they could not get steam on the main boiler until ten o'clock on the following morning, to which the complainant rejoined, "Very well, get it on as soon as you possibly can." At five o'clock the captain went on deck. He found no one in the stoke-hole, and noticed that no preparations had been made to get up steam. He (Mr. Hearfield) contended that the men ought to have been occupied in getting up steam. His Worship: And that the defendant neglected to give the necessary orders for this to be done is a wilful disobedience of the lawful command.—Mr. Hearfield: Yes. On the following morning a little before seven the master again went on deck and found no one in the stoke-hole. He subsequently saw the chief engineer, and asked him why his order had not been obeyed. Defendant replied that it was a rule to work from seven to five o'clock, and he was not going to differ. Captain Newman told him it was the the third time he had disobeyed his orders, and he should "log" him for wilful disobedience.—Dr. Rollit: We deny these facts, Steam was ready at the time named, and the work was being done.—Mr. Hearfield: He did not go and get steam up on the main boiler as soon as he might have done.—Captain Newman was then called. He said the *Rinaldo* was at Cronstadt on the 20th ult. At two p.m. on that day, acting from information given him by the chief officer, he ordered the defendant to get steam on the main boiler. It was not got up during the afternoon, and was not up at seven o'clock the following morning. He saw Crawford, and, in addition to his reply as to the hours, he said that Mr. Taylor, Messrs. Wilson's deputy-superintendent, had given him orders not to light the main boiler. Witness told him that Mr. Taylor had nothing to do with the ship in that instance. He (the master) was responsible, and if he were wrong, he would be made responsible for it. Defendant then told him that he would have him before Mr. Newbald and Mr. Cameron. Witness then said he should "log" him.—In reply to Dr. Rollit, complainant said it was his intention, if he had had steam on the main boiler, to have used it in discharging the cargo that night. It would have taken three hours to get steam up, and would have been ready a little after five o'clock. Work was discontinued for the day soon after six. Witness did not know that the boiler was being repaired. —In reply to his Worship, complainant said if steam had been got up on the main boiler that afternoon, it would have been ready between five and six o'clock. Work would have been discontinued about three-quarters of an hour after. His Worship: When you discovered at five o'clock that steam was not got up, why did you not see defendant?—The master: I had given him an order, and I did not think it necessary to repeat it.—Dr. Rollit, for the chief engineer, said they did not dispute the master's authority in any respect. He was the master of the vessel, and was acknowledged to be so by the defendant. His client was ordered to get up steam. He informed the master that he could not get it up until ten o'clock on the following morning. The boiler was then under repair, the repairs being necessary before it could be used. The master said he was to get it up as soon as possible. The boiler was repaired as quickly as possible, and, as defendant had promised, steam was got up at ten o'clock the following morning. It was not his intention to act in contradistinction to the master, and no disobedience was intended. He had witnesses to call in support of his statement.—Mr. Hearfield said that, after the explanation of Dr. Rollit, his client was fully satisfied with his authority being acknowledged, and he would not press the case further.—Mr. Twiss: I think this is a satisfactory termination. The summons will be dismissed.—No order was made as to costs.

THE NEW MARINE MONSTERS.

THE *Nautical Gazette* of New York says:—To our mind, steamers of the *City of Rome* type do not present the characteristics of success, either in point of naval architecture or business qualifications, in the transatlantic trade, such as their great cost should command. They may have and doubtless have many features which will make them popular ships with the traveling public, but the question is will they be remunerative to their owners. In size the *City of Rome* is imposing and attractive, but it remains to be seen if her huge proportions are not a great drawback when her success as a commercial venture is considered. Her model is by no means such a one as we should build upon, for she is not able to "stand on her feet" either in reasonable ballast or with a portion of her cargo in, and as soon as she begins to discharge she must begin to load or she will topple over, despite the heavy weights in her machinery department. Her crankiness is a terrible drawback. To coal her, she must be shored off the wharf, so that coal-boats can work on both sides at the same time, and thus become an obstruction to her neighbours' ships, and if the gang on either side of her knocks off work for a few minutes, the ship lists over quickly and she must be trimmed or she is down on her beam ends. Her maximum draft mark and her Plimsoll mark provides that she may go to sea legally drawing 31 feet of water, but this deep loading is only possible in leaving Liverpool, and cannot be practiced from this port with safety or surety, as the bar at Sandy Hook will not permit it. Therefore, we argue, the ship must of a necessity either go to sea partly laden or take large risks to her stern frame, propeller and rudder, if she loads down here to her legal draft. But from what we learn she by no means is able to carry cargo in proportion to her size, as her machinery and bunkers have made serious inroads upon her freighting capacity. Unless she comes up to her estimated speed, 17 knots, which, we think, she will not be able to do, it will be difficult to handle the inward or outward cargo in the usual time ships of her class lay in port at either end of the route. This would be another serious drawback, and tend to the slighting of the stowage of the cargo, which might result in serious injury to the cargo, if not to the ship herself. Her expenditure of coal, said to be over 200 tons per day, is a serions item of cost, especially if the price of the commodity reaches a high figure, as at times it does. The *City of Rome* took on board here, on her maiden voyage, 2,000 tons o coal, enough to load a moderate-sized steamer. To sum up, we hear that, from a commercial standpoint, this monstrous steamer cannot be termed a success. Certainly her "tenderness of stability," which is due to faulty designing and modelling, makes her a failure, so far as naval architecture is concerned. When west-bound freights are scarce, and coals high, we cannot see how she can "earn her salt" between Liverpool and New York, and, being so crank, we must expect that she cannot be driven to full speed, and as "time is money," such a trip, under such circumstances, would be a losing one indeed. We think the Inman Line was led into a grave error when it allowed itself to contract for such a large vessel, and it will find that should she have to be docked here to repair damages, it would be a very serious matter to handle her on our docks, and her only hope would be in the use of the coffer dam system. As the boys say, she is "too much of a good thing," and we think the stockholders of the company will agree with us ere many months roll around. Yet they may, as an offset, console themselves that she is next in size to the marine white elephant, yclept *Great Eastern*.

THE TWIN SCREW STEAM DREDGER "PROGRESO."

ON Thursday, December 8th, 1881, the *Progreso*, a twin screw steam dredger, was launched from the shipbuilding works of Messrs. J. & G. Rennie, of Greenwich.

The launch of this vessel is notable on account of the fact, that it brings a second contract for the Argentine Republic nearly to its termination. The first contract entered into by the firm mentioned, was for the building of a twin screw dredger named the *Riachuelo* and twelve hopper barges. The work they were required to perform, was to dredge a channel through the mud bank which exists at the mouth of the river Riachuelo, which would allow vessels of from 18 to 20 ft. draught, to enter that river and discharge their cargoes alongside wharves to be constructed for that purpose.

This river bounding as it does a large portion of Buenos Ayres, will become by being opened up in the manner the Argentine Government intend, a second Mersey or Clyde for ship-traffic and commerce. It is well known to all who are in any way acquainted with the navigation of the Rio de la Plata, that for the last half century, the immense mud bank which lies off Buenos Ayres, has been the greatest drawback to vessels wishing to discharge or take in cargo at that port on account of the great distance it was necessary for them to anchor from the shore, which was from two to three miles. About ten years ago, the government took into serious consideration the necessity of removing this great obstacle, to the development of their vast resources.

Their first step in this direction resulted in the determination to cut the channel referred to. For this purpose, a contract was entered into with Messrs. J. & G. Rennie, to build a twin screw dredger to be named the *Riachuelo*, capable of dredging about 400 tons per hour. The vessel was 156 ft. 6 in. in length; 28 ft. in breadth; 10 ft. 1 in. depth of hold, and 5 ft. 3 in. draught of water. The main engine worked the dredging apparatus, and by means of gearing propelled the vessel, and worked the winches for heaving ahead or astern.

To carry away the dredged soil and deposit the same in deep water, twelve hopper barges were ordered, 85 ft. long; 18 ft. broad. and 7 ft. 5 in. depth of hold. These were each capable of carrying 100 tons of soil. With this plant and the addition of a much smaller dredger, and a tug to tow the barges, the Argentine government in the course of between five or six years succeeded in cutting a channel through the mud bank three miles in length, 100 ft. in breadth, and 20 ft. in depth. They also dredged the river Riachuelo from its entrance for about two miles, to the depth of from 16 to 18 ft. The success following this undertaking was so great, that the Argentine Republic in 1880, decided to increase the depth of the channel, to increase its breadth from 100 to over 300 ft. (100 metres), and in deepening it, to dredge eight miles from the shore towards the bed of the river Rio de la Plata. The river at this part being about thirty-two miles in breadth. It was also decided to dredge the river Riachuelo for two and a-half miles of its length from the entrance, to a depth of 20 ft. To dredge and dig at the entrance on the right hand bank five large docks, and beyond these, to construct an unbroken line of wharves two miles in length. Large piers are also to be built on each side of the channel in the shallowest water, to prevent the mud silting up and closing it, whilst in the deeper portion occasional dredging will keep the channel open.

For this purpose a contract was entered into for Messrs. J. & G.

SCREW EXPERIMENTS (By Chief Engineer ISHERWOOD, U. S. Navy).

TABLE No. 2, Containing the Distribution of the Piston Pressures and of the Indicated Horses-Power during the Experiments made in 1880, in the Potomac River, by a Board of United States Naval Engineers with the Different Screw Propellers Applied to the Fish Commission's Steamer "Lookout," for the Purpose of Ascertaining the Best Proportions of Screw for that Vessel.

The piston pressures in this Table are the pressures that would have been upon the piston of the large cylinder had the pressures upon the piston of the small cylinder been reduced in the ratio of the net area of the piston of the large cylinder to the net area of the piston of the small cylinder, and the quantities thus obtained added to the observed pressures on the piston of the large cylinder. The capital letters at the head of the columns in this table designate the same experiments as are given in the columns of Table No. 1 with the same letter headings.

No. of Line.				Hull not Coppered.					Hull Coppered.	
				A	*B*	*C*	*D*	*E*	*F*	*G*
1			Date of experiments...	Jan. 19, 20 & 21	Mar. 26, 29 & 30.	Jan. 7, 10 & 15	Apr. 1, 2 & 3.	June 23, 26 & 28	Oct. 19 & 20.	Sept. 24 & 25.
2			Speed of the vessel per hour, in geographical miles of 6086 feet	9·5346	10·0974	9·6264	10·4190	10·1929	9·9390	9·7493
3			Slip of the screw, in per centum of its speed	24·4072	13·6772	18·0439	20·1542	17·9739	21·9620	12·7150
4			Thrust of the screw, in pounds	1650·9925	1851·0375	1688·6734	1970·5470	1909·3913	1643·8234	1580·2261
5			Double strokes of engine's pistons, and revolutions of the screw made per minute	152·3085	158·1988	158·8560	153·4601	140·0500	143·5402	143·4125
6	Distribution of the indicated pressure on the piston.		Indicated pressure on the piston, in pounds per square inch...	21·9103	23·0038	20·4793	25·8904	26·8090	23·4011	21·3831
7			Pressure required to work the engine, *per se*, in pounds per square inch of piston...	2·7164	2·7164	2·7164	2·7164	2·7164	2·7164	2·7164
8			Net pressure applied to the crankpin, in pounds per square inch of piston	19·1939	20·2874	17·7629	23·1740	24·0926	20·6847	18·6667
9			Pressure absorbed by the friction of the load, in pounds per square inch of piston...	1·4395	1·5219	1·3322	1·7380	1·8069	1·5514	1·4000
10			Pressure expended in overcoming the resistance of the water to the surface of the screw blades, in pounds per square inch of piston	1·1537	2·2522	1·2704	1·0914	1·7154	1·4241	2·3233
11			Pressure expended in the slip of the screw, in pounds per square inch of piston...	4·0518	2·2586	2·7355	4·1003	3·6973	3·8893	1·9000
12			Pressure expended in the propulsion of the vessel, in pounds per square inch of piston	12·5489	14·2550	12·4248	16·2443	16·8730	13·8199	13·0434
13	Distribution of the indicated horse-power.	Absolute.	Indicated horses-power developed by the engine ...	84·4804	92·7090	82·3573	100·5812	95·0489	85·0341	77·6320
14			Horses-power expended in working the engine, *per se*...	10·4737	10·9475	10·9239	10·5529	9·6307	9·8707	9·8620
15			Net horses-power applied to the crankpin	74·0067	81·7615	71·4334	90·0283	85·4182	75·1634	67·7700
16			Horses-power absorbed by the friction of the load ...	5·5505	6·1321	5·3575	6·7521	6·4064	5·6373	5·0827
17			Horses-power expended in overcoming the resistance of the water to the surface of the screw blades	4·4483	9·0767	5·1089	4·2398	6·0816	5·1748	8·4348
18			Horses-power expended in the slip of the screw... ...	15·6225	9·1025	11·0008	15·9291	13·1084	14·1328	6·8982
19			Horses-power expended in the propulsion of the vessel...	48·3854	57·4502	49·9662	63·1073	59·8218	50·2185	47·3543
20		Proportional.	Per centum of the net horses-power applied to the crankpin, absorbed by the friction of the load	7·5000	7·5000	7·5000	7·5000	7·5000	7·5000	7·5000
21			Per centum of the net horses-power applied to the crankpin, expended in overcoming the resistance of the water to the surface of the screw blades	6·0107	11·1014	7·1520	4·7094	7·1198	6·8847	12·4462
22			Per centum of the net horses-power applied to the crankpin, expended in the slip of the screw	21·1096	11·1330	15·4001	17·6934	15·3462	18·8028	10·1788
23			Per centum of the net horses-power applied to the crankpin, expended in the propulsion of the vessel	65·3797	70·2656	69·9479	70·0972	70·0340	66·8125	69·8750
24			Relative economic efficiencies of the screws, expressed by the quotient of the division of the cubes of the speeds (line 2) by the net horses-power applied to the crankpin (line 15)	11·7122	12·5049	12·4880	12·5632	12·3978	13·0624	13·6733
25			Quotients of the division of the quantities on line 23 by those in line 24	5·5822	5·6190	5·6012	5·5796	5·6408	5·1149	5·2103

Rennie to supply two dredges and five hopper barges of much larger dimensions, and capable of doing a greater amount of work. In the first instance, the hopper barges, some of which are now on their way to Buenos Ayres, are each fitted with single screw propellers, and will carry in their hopper 300 tons of soil. The engines are inverted one high pressure cylinder 20 in. in diameter and one low pressure 38 in. in diameter, surface condensing. The boilers are cylindrical with horizontal iron tubes, suitable to 65 lbs. steam pressure. The boiler is 8 ft. 7 in. in length, and 8 ft. in diameter, with a heating surface of 700 square feet. The speed attained on official trial with the barges loaded to 8 ft. draught, was about 8½ knots, the contract being for 7½ knots. The barges are designed and constructed as efficient sea-going vessels, in compliance with Lloyd's Rules and the Board of Trade Regulations. Between decks forward there are two spacious cabins, one for the captain and the other for the chief engineer, and double bed bunks, lockers, &c., for the crew. For the passage out the hopper doors, besides being carefully hove up by means of the powerful winch at each end of the hopper, is firmly bolted and secured to temporary wooden cross beams, and well caulked. They are also completely fitted and rigged as schooners with a large flying fore course. The large dredger, *Progreso* just launched, is 175 ft. long, 31 ft. moulded breadth, and 10 ft. depth of hold. She is capable of dredging to a depth of 32 ft. The engines consist of a compound surface condensing high-pressure cylinder 29 in. diameter, and a low-pressure cylinder 50 in. diameter, with a stroke of 3 ft. The boiler is cylindrical, with horizontal iron tubes, suitable to 70 lbs. pressure, with a heating surface of 1,400 square feet. Its length is 18 ft., and diameter 8 ft.

A crab-winch is fitted in the bow for heaving the vessel ahead, when dredging with one centre barrel for head anchor chains, and two end barrels for shifting pins, buckets, &c., fitted with two cylinders, each 1½ ft. diameter, fed from the main boiler. The main engine used for dredging is 70 nominal horse-power, and is suited by means of gearing for propelling the vessel at about 8 knots per hour, or for working the 4 capstans placed one on each bow and one on each quarter for side dredging operations.

The length of the bucket-ladder is 81 ft. The number of buckets fitted for use at one time are thirty-two, each having a capacity of 15½ cubic feet, and capable, under ordinary circumstances, of dredging about 600 tons of soil per hour. The hull is constructed with every possible requirement for strength to class at Lloyd's, and extra stiffness under engines, boilers, and machinery, particularly the foundation to upright shaft to prevent shocks in dredging. Due attention has also been paid to the subdivision of the dredger (as likewise the hopper barges) into water-tight compartments. For the voyage out, she will be fully equipped and fitted as a three-masted schooner. The bottom of the dredging well will be planked and caulked, and the space used for cargo, &c.

Every accommodation is provided in the shape of cabins for the captain, engineers, boatswain and carpenter, and separate spaces fitted with double bed bunks, lockers, tables, cupboards, &c., for the firemen and seamen.

This dredger will be used for the deep channel work at the entrance to the Riachuelo.

The dredger to be used in the river Riachuelo, is erected ready for inspection before shipment to Buenos Ayres for re-erection and completion. She is named the *Lesseps*, and is built in the shape of an oblong tank, being perfectly square at the ends and sides. The dredging will extend right through the fore end to admit of the vessel cutting her way ahead as well as dredging to a depth in the usual manner. With the exception of the gearing for propulsion which is not required in this vessel, she is very similarly fitted to the large dredger on a smaller scale.

The Argentine Government are anxious to commence operations with this new dredging fleet, well knowing the great task they have before them, as, even with this addition to their dredging plant, it is calculated that from 15 to 20 years will elapse before the final completion of the operations, which will undoubtedly raise the port of Buenos Ayres to the position of the largest and most accommodating haven on the south-east coast of the Continent of South America.

AN ironclad corvette, which has been built in the Vulcan Dockyard for the Chinese Government, was successfully launched in the presence of General von Stosch, Chief of the German Admiralty, and Herr von Boetticher. The Chinese Ambassador performed the office of christening the vessel, giving it the name of *Tingyuen*.

OUR ROYAL MARINE ENGINEERS AND ENGINE ROOM ARTIFICERS.

MUCH has been said and written of late concerning our Royal Naval Engineers, and the necessity of improving their status in the service as officers and gentlemen. The origin and development of the royal naval engineer as an important addition to the ever-increasing requirements of our improved men-of-war is a matter deserving the consideration of all interested in the art and progress of marine engineering, and a general knowledge on this point may be obtained without referring to a remote date, seeing that the engineer was introduced into the service well within a half-century ago. During the earlier portion of this time our war vessels were fitted with paddle wheels and single screws, the propelling engines in each case being of a comparatively simple form of construction, the power developed by the engines was also particularly small when compared with the powers now worked to, and the amount of coal carried by a first-class wan-of-war between 30 and 40 years ago was ridiculously small. In fact, during the first half of the time in which steam propulsion has been employed in our royal Navy the propelling power of the machinery only held a secondary position in driving the vessel, the sail power being the primary agent of propulsion. In the earlier stages of the royal marine engine it was only applied and used as an auxiliary power, which was very handy in the case of prolonged calms, head winds, and on nearing land or going into harbour. The introduction of the engineers and stokers in very limited numbers, as compared with the immense crew of admiral, captain, commander, lieutenants, sub-lieutenants, midshipmen, warrant officers, quartermasters, petty officers, and seamen, in our ships of war was looked upon by our older seamen and officers as an unnecessary nuisance and infliction; and even the benefit of progressing on a voyage through a dead calm, making good headway dead in the teeth of a gale, or saving the vessel from being driven on a lee shore, hardly compensated our old man-of-war's man for the dirt, grime, and smoke introduced by the use of the machinery in their otherwise scrupulously clean ship, destroying once and for ever the snowy whiteness of decks and sails, which our former navy excelled in and prided itself upon, as compared with foreign navies. In this earlier stage of the existence of the royal marine engineer, the position they held on board a man-of-war was in many cases a most unenviable one. The commissioned officers of all grades kept aloof from them, the chief engineer of the vessel excepted, he being rated as a ward room officer, and *allowed* to mess with the lieutenants, paymasters, and surgeons. The other engineers, at this period, had a mess and living cabin combined, of very limited dimensions, outside of which they slung their hammocks at night. During their hours of recreation the commissioned officers of the vessel enjoyed their cigar and chat over the full area of the quarter-deck (that is from the mainmast to the taffrail); the sailor smoked, sang, danced, and frolicked on the forecastle, whilst the marine engineer officers, a solitary few, unable, owing to the name they bore as officers, to join in the sports of the seamen, and not privileged to tread the sacred boundary of the quarter-deck, slowly paced the narrow and confined portion of the vessel termed the waist, a narrow strip of deck on each side of the boiler and engine-room hatch, which formed a kind of neutral ground between the commissioned officers and the seamen.

About 25 years ago the introduction of the armour-clad in our navy, and an increase in the size and power of the engines and boilers to produce a higher rate of speed, as well as to propel a much greater weight, drew some official attention to the use and value of the royal marine engineer. As the supply of this branch of H.M. service was principally obtained from mechanical and marine engineers and fitters from our royal dockyards, it was considered by the Admiralty that, as steam machinery was bound to form a leading feature towards the perfection of our man-of-war, it would become incumbent on them to train and fit practical and theoretical engineers, competent to manage and improve the complication of mechanism our marine engines at that time were beginning to develop. Previous to this, the marine engineer obtained from our royal dockyards was entered into the service, in the first instance, as a factory boy, and engaged in the various machine and boiler shops of the engine factories till he reached the age of manhood, when, according to his ability and skill as a mechanical marine engineer, he would obtain a recommendation and a rating as an engineer in H.M. Royal Navy. The perfecting himself in the theory of his profession was a matter left entirely to his own taste. The importance of the marine engine, and necessity for improvement in knowledge and skill in this direction, led the Admiralty, at a later date, to issue an order that, for all entries into H.M. dockyards of lads to be trained and fitted as marine engineers, a strict Civil Service examination was to be instituted, and only a limited number of competitors to be chosen, all of whom were to obtain over a certain number of marks in each subject they were examined in. These successful competitors were to be indentured marine engineer apprentices. Not satisfied with this, these lads were required to attend a Government school during a portion of their time for the first three years of their apprenticeship, and to compete at examinations in higher subjects every six months; the most promising lads being employed, as their knowledge of the practical part of their business increased, in the different drawing and designing offices, and finally passing trying examinations to gain an appointment in the royal navy as third and fourth class engineers.

(To be continued.)

* OCEAN STEAMSHIP MACHINERY.

A SERIES OF PRACTICAL PAPERS ON THE DESIGN, CONSTRUCTION, AND MANAGEMENT OF THE MACHINERY OF STEAMSHIPS.

By H. Holt-Butterfill, Marine Engineer.

As no work, to the Author's knowledge, at present exists, which covers the same ground or gives the kind of information, which is attempted to be conveyed in these papers, in a way to be of direct *practical* use to the classes for whom they have been specially prepared, he deems it unnecessary to offer any apology for their appearance now.

The great demand, which is looming in the immediate future, for a more thorough technical and trade education than now obtains for our managing engineers, sea-going engineers, draughtsmen, foremen, and workmen, encourages their author to hope that these practical papers, which are the results of many years' experience in the office and workshop and on ship-board, may supply a want which has long been felt by all who have had anything to do with the production and management of ocean steamship machinery.

The subject-matter of our papers embraces in detail all the machinery and accessions now required in an ocean-going steamship, and the work we set ourselves to accomplish in connection therewith being for the special information of a not unimportant section of our industrial community, many members of which have not had opportunities of obtaining a mathematical training, we have endeavoured to give to our remarks as practical a character as possible, and not to burden them with abstruse theoretical investigations of the great principles involved in the action of the motive power of steamships—a subject which has already been so ably treated by others—but rather to make use of the results of those investigations as they bear upon the subject we have under discussion.

Nor has it been our purpose in these papers to enter at any length into that interesting subject—" the history of the application of the motive power of steam to the propulsion of vessels at sea "—it being, we think, sufficient for our readers to be informed on this head as to the reliable facts obtainable in connection with the more modern *successful* application of means to that end.

We have in all cases, so far as it is possible, given such information on all the matters that come under consideration as we think is necessary to be known by the student, and although we have in a previous paragraph eschewed *abstruse theoretical investigations*, we do not thereby imply an intention to discard theory altogether, for without it there can be no successful practice.

Our aim has been to combine the theory of each part of the subject with its practical application, that the student may be led to see the inter-dependence of each with the other, and be brought to the conclusion that to become a successful engineer it is necessary that he should understand the *why* and the *wherefore* of every part of his design, and the special purpose it is intended to serve.

So far as the "construction" of the machinery of steamships is concerned, we have not thought it necessary to enter into those details of workshop practice which every studious workman and apprentice will see to be to his interest to thoroughly master. But where *principles* and *laws* are involved, as in changing the nature of movements, friction, &c., we have endeavoured to explain them as concisely as we are able, and have shown how the results of the reasoning are practically applied.

As upon the correct adaptation and fitment of the machinery to the ship, much of her future success in the matter of her propulsion through the sea will depend, the latest practice of the best of our marine engine builders is given in detail when treating of these matters. And as the successful application of the screw propeller is still an unsettled question, the latest reliable results obtained in practice as to form, proportion, &c., are given in their appropriate place.

The judicious *management* of steamship machinery, both in port and at sea, forms a special feature in these papers, as upon it so largely depends the success of a steamship as a commercial venture, and as fulfilling the intentions of her builders in the matter of realized power, speed, and consumption of fuel.

As in these days of rapid passages, incessant employment, and short stoppages in port of ocean-going steamships, the care of the *hull*, in a measure, devolves upon the engineering staff, the results of a practical experience of some years in these matters is given in the hope that they may be found of service to many who may wish for such information.

The type of machinery discussed in these papers is that which now usually prevails in ocean-going steamships—viz., single or double compound inverted direct-acting surface condensing engines, with either single or double-ended circular return tube boilers, together with all the accessories required for feeding boilers, pumping ship, discharging and taking in cargo, and working ship at sea or in harbour.

It is assumed that all who seek for information in these papers are practically acquainted with arithmetic and elementary algebra, and have sufficient knowledge of mechanical drawing to be enabled to follow the directions given in getting out the design of any portion of machinery under description.

(To be continued.)

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* The Author reserves the right of re-publication and translation of these papers.

BOURRY'S IMPROVEMENTS IN STEAM BOILERS AND STEAM JOINTS.

THESE improvements are embodied in a most characteristic way, as will be shown by reference to the accompanying plate. This plate represents a horizontal marine boiler, capable also of application for stationary and many other purposes. It will be seen to consist of the type known as the water-tube boiler, constructed by a most novel arrangement of tubes and joints. The main purpose in the present construction of water-tube boilers is the reduction of weight to the lowest possible limit by employing but small thicknesses of material throughout, and yet combining unquestionable safety, together with the exclusion of all heated surfaces which are not actually steam producing. The most striking peculiarity noticeable in the plan followed out by M. Bourry in his method of construction is the formation of the very walls or boundary of the whole boiler by rows of tubes, in close longitudinal contact, and at right angles to each other, fastened to the sides of somewhat larger tubes, whereby a square-looking, box-like body is established, the larger tubes forming the corners, and the rows of smaller tubes the sides. The contents of all these tubes together constitute the water spaces between the fire side and the outer atmosphere.

Within the hollow space bounded by the four tube-walls are superposed rows of still smaller tubes connecting pair by pair the corresponding side tubes opposite each other, and between which the fire and heated gases are made to pass.

In order to preserve the advantage of accessibility without loss of heat by radiation, and any sensible addition of weight, the usual casing of non-conducting material is replaced by a jacket of thin sheet metal, leaving a certain layer of air between by a current, of which the radiated heat from the boiler is carried off and through the grate to the fire, in which way it is completely turned to profit again, while the surroundings remain perfectly cool; a most appreciable advantage on board ships, where so many efforts are made to keep the stoke-hold cool, necessitating in large vessels—especially the man-of-war class—a complex ventilating arrangement.

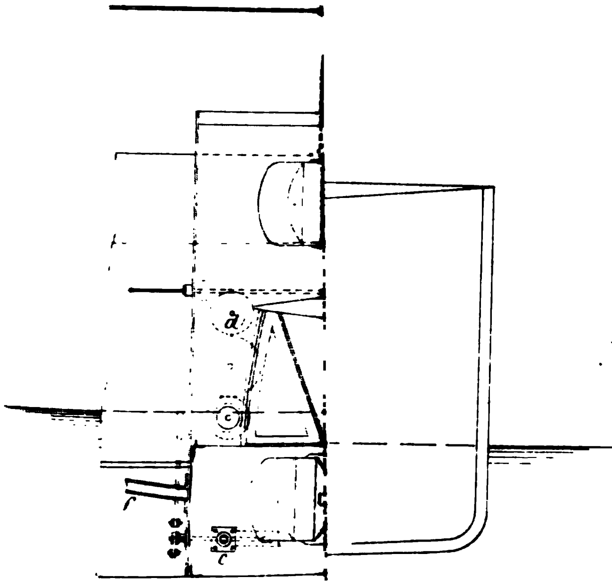
The junctions of this novel form of boiler are made in the following way :—The bosses of the corner tubes are tapped inside; so is also the widened end of the side tubes for a limited distance. Further on a very smooth cone is made tapering towards the inside of the tube; the ferrule, which is provided with a little socket at its end, receives therein a well-fitting ring of copper or other soft metal, the outer diameter of which corresponds exactly with the base of the cone in the side tube. On screwing in the ferrule the ring is pushed forward and forcibly compressed within its socket until complete tightness is obtained.

At the same time another similar ring in a socket made on the inside of the corner tube boss is also compressed by the action of a conical part of the ferrule; the said two rings by their particular position cut off all access of steam or water to the screw thread, whereby the latter is secured against oxidation, and does not offer any exceptional resistance to unscrewing. The screw plugs closing the holes through which access is had to the connections, and which also serve for cleaning, are likewise provided with a cone compressing a light ring as above for making a tight joint, and being also situated on the water or steam side of the screw thread to preserve the latter against deterioration.

It will thus be seen that the compression of the interposed body for effecting tightness is not taking place in the direction of the axis as usual, but either radially or concentrically. The boiler illustrated in accompanying plate will convey a general good idea of the improvements and particular construction above noted. *A A* are the corner tubes, *B B* the side tubes, and *C C* the cross tubes. The hollow spheres, *O O*, belonging half to the water space and half to the steam space, are intended to obviate all fatal undulations in the total water level arising from the motion of the ship or from differences in the degree of ebullition along the boiler. The cylinders, *N N*, contain nothing but steam, and are connected to the spheres by elbows to give the necessary flexibility for unequal expansion; *K* is the uptake attached to the smoke-box, which reaches into the boiler to where the cross tubes commence from that side; it is made to keep off the contact of the heated gases with the last couples of side tubes in order to favour the return current of the water therein; *L* is the smoke pipe.

The grate, *G*, consists of a certain number of parallel water tubes lengthways with the boiler, and terminating at each end in larger tubes which run across; of these only one is connected to the sides of the boiler, forming the water spaces; the other is merely supported in its middle by the feed water-pipe to admit of a free expansion and contraction of the whole of the grate; the feed water is first directed from behind through the grate before entering the boiler, as by its lower temperature it prevents the presence of too much steam in the grate tubes, and preserves them best from burning through; *R R* are baffle plates vibrating round the corner tubes $A^1 A^1$, and serving to direct the air current at will, up or downwards through the grate, in which latter way the furnace becomes smoke-consuming, and affords also greater facility in stoking. The left side of **Fig. 3** shows the relative position of said plates for the up, and the

PEDO BOATS OR OTHER VESSELS



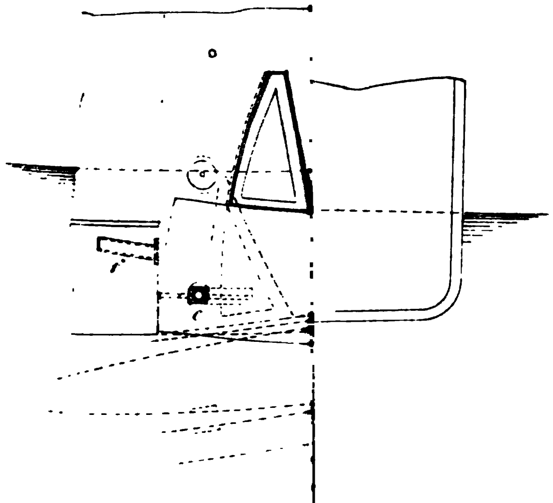


FIG. 3.

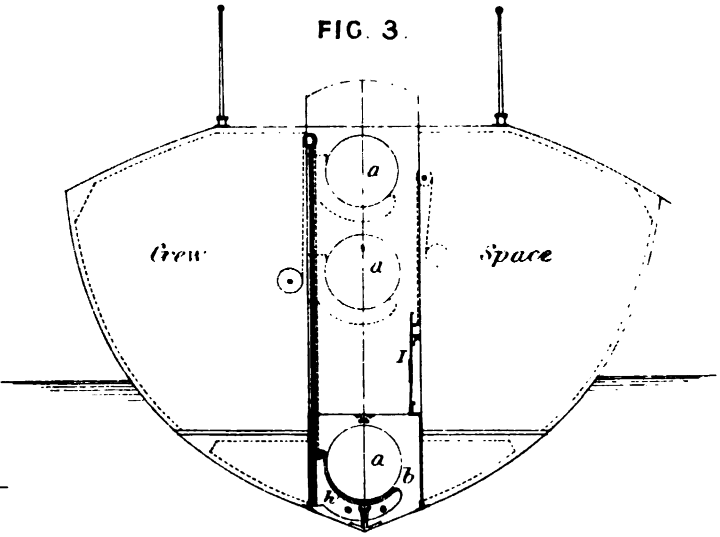

a
a
Crew
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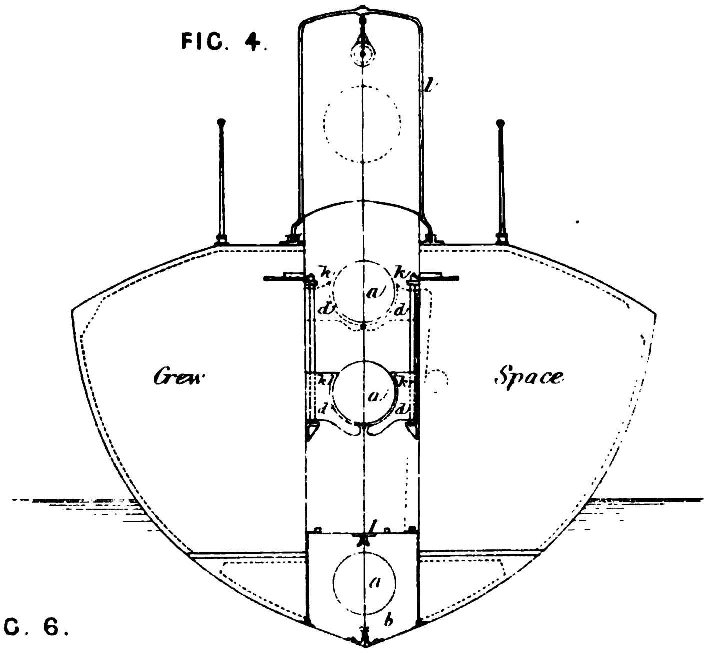
FIG. 4.


l
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Crew
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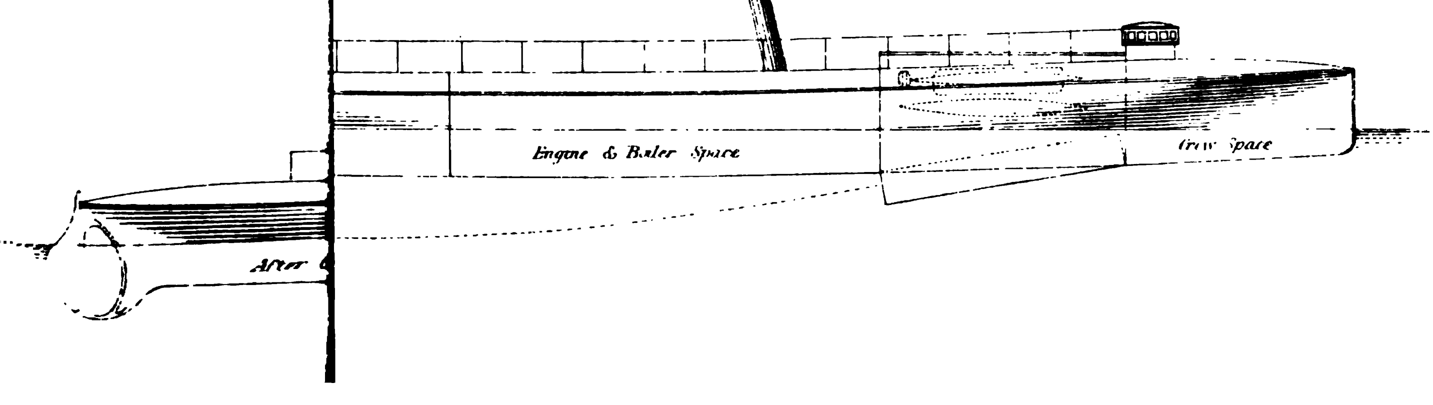
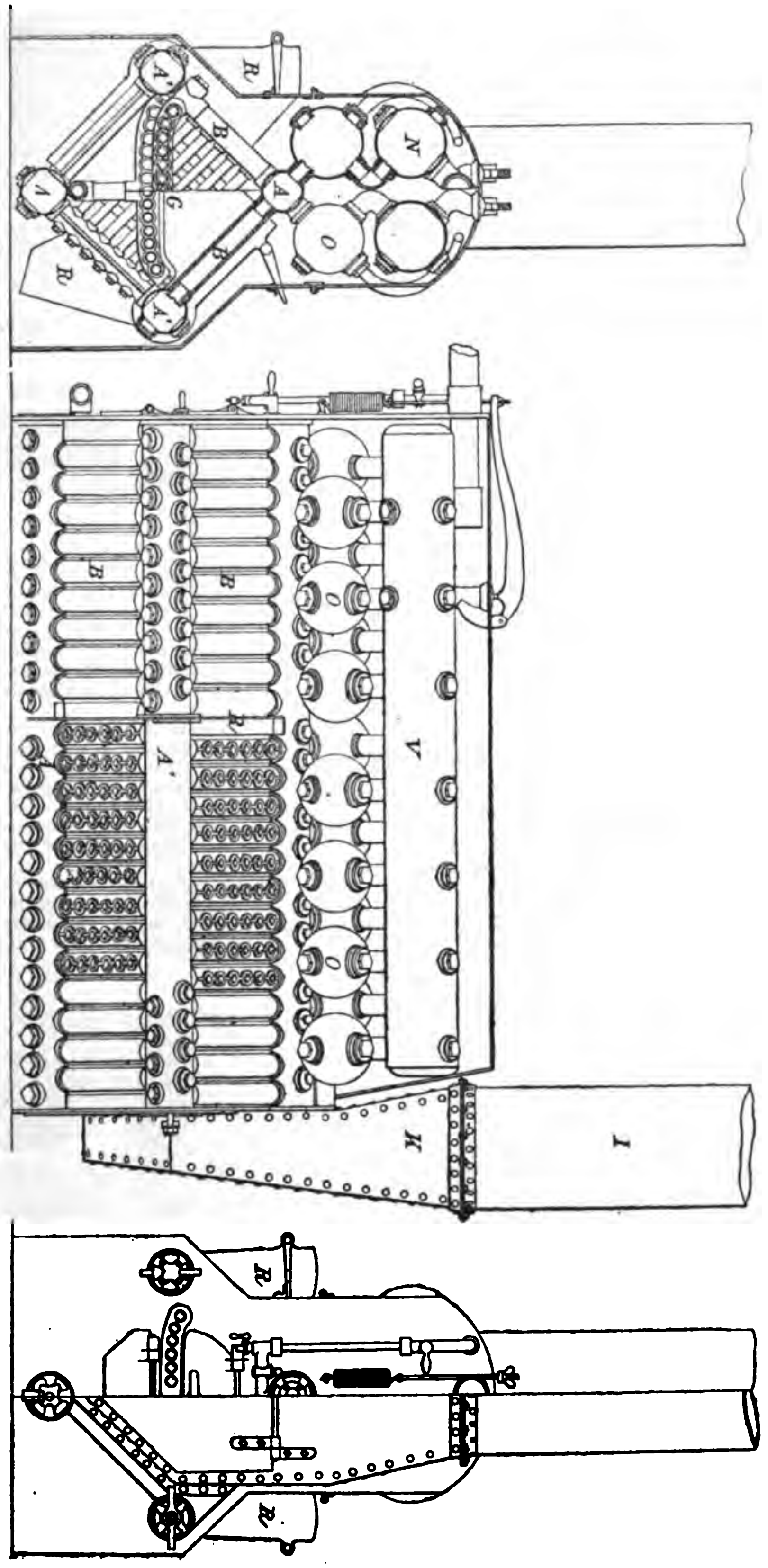
FIG. 6.


Engine & Boiler Space
Crew Space
After


R
A
B
G
N
O
A'
V
K
I

BOURRY'S IMPROVEMENTS IN STEAM BOILERS AND STEAM JOINTS.

right side for the down current. The air between this boiler and its jacket may be caused to flow when heated by radiation through the burning fuel, in which case the front plate is made double.

EXPERIMENTAL RESEARCHES INTO THE PROPERTIES AND MOTIONS OF FLUIDS WITH THEORETICAL DEDUCTIONS THEREFROM.

By W. F. Stanley.

THE treatment of this highly important subject by the author opens up a large amount of new theory in the principles of the sciences of hydrodynamics and acoustics; the volume containing the results of observations and experiments most carefully conducted and worked out by several years of application and study, although embodying between 500 and 600 pages, is so full of explanations leading up to the simpler application of mechanical laws to all fluid matter that every chapter and page will be followed with interest, and it will be seen that nothing has been overlooked to render this work as complete as possible, and that none of the matter could be spared without breaking the continuity and regularity which every problem has been worked out, and each result arrived at. The writer of this valuable work had been formerly engaged in close experimental examination of the undulatory theory of light. Observing the similitudes of the motions of water waves and sound waves, he decided to extend his observations to become assured if these conceptions were real. It was believed by Mr. Stanley that in science, with respect to fluids, too great reliance had been placed on some ingenious theoretical idea, which was not clearly and sufficiently supported by direct observations, or by experiment, therefore necessarily only brought to bear on facts by the introduction of somewhat arbitrary functions, whereas too little dependence had been placed on purely inductive methods. The investigations here laid before us are conducted on the theory that oscillation enters as a principle into wave motions at all times, although most evidently in the dissipation of impressed forces to equilibrium upon the open liquid surface. The first chapter contains some theory on the fluid condition consistent with acquired knowledge the matter, and with experiments made by the author, particularly to account for the rigidity and yet mobility of liquid systems.

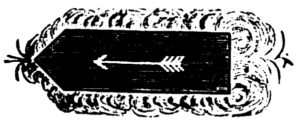


Fig. 1.

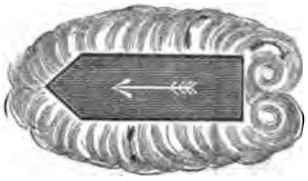


Fig. 2.

It is here shown that fluidity may be taken to be a very general physical property of matter in some degree, and this has been taken advantage of in some of the experiments made in the work before us. At the same time, a perfect state of fluidity does not exist in any material body, all fluids being found to be in different degrees cohesive, viscid, plastic and elastic, possessing internal construction of parts; or chemical arrangements which do not admit of a perfect mobility of the separate parts which would be necessary for the condition of perfect fluidity. The apparent homogenity of fluid matter, the constructions of atoms, gases and liquid molecules, the cohesion of liquid molecules, and general remarks on fluidity, are set forth and explained in the opening chapter. The 12th propositions setting forth the elastic rigidity of the fluids, air and water, as of the same kind as that observable in gelatinous bodies, agrees with other former experiments in this direction, and the whole chapter is well illustrated by diagrams explaining the author's experiments and results, the nature of these being so connected that it is impossible to notice or discuss any particular portion apart from the whole. The 2nd chapter, enters into the conditions of liquid surface; capillary action; tension of films; bubbling, boiling and evaporation. In this chapter, the author differs from the generally accepted theory of *tensile* surface for liquids, founded on the researches of many former philosophers, and takes quite an opposite view, viz:—that such surfaces are *extensile* instead of tensile; except for free films, which are clearly *tensile* by the attractive matter which composes them. In defining tha words *tensile* and *extensile*, it should be taken that *tensile* is a disposition of the parts of a system of matter to draw themselves together as a stretched drum-skin does, and *extensile* the reverse of this, or the disposition of the parts of a system of matter to separate and thereby to engender external pressures. The theories and propositions given in this chapter, have so far as worked out and explained everything to recommend them to the careful study and application of theroists.

Chapter 3, on flowing forces, contains examples and equations on oblique and gravitation impulses; efflux and directive forces; traction and cohesion on traction of liquids. The examples given on the movement of a liquid toward a hole in the bottom of a vessel, the action of hydrostatic pressures with gravitation over and about the hole, &c., is a subject demanding such attention, that a future notice on this head, comparing the theories put forward with existing theories and the methods of mechanical application, will be necessary to convey an adequate idea of the value of this chapter.

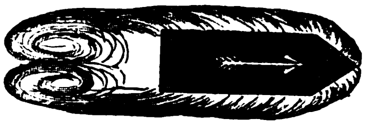


Fig. 3.

Chapter 4. We here find the author introducing a theory of the motion of fluids entirely new, in many respects, which may be condensed in the words "that fluids move by *rolling contact* upon their own parts and upon solids." The propositions and definitions given on the motive contact of fluids upon solids, and upon parts of their own or other systems, with the principles of rolling contact in fluids moving upon lateral resistances, calls for the closest attention of our shipbuilding theorists and mathematicians, as also our civil engineers. The ship designer and calculator should consider the frictional skin resistances on vessels moving through the water as that of a continual rolling contact, which would alter the formulæ now in existence on skin resistance; and the civil engineer would likewise profit by considering the fluid motion on inclines and through pipes as that of a rolling motion, to some extent at the sides of the pipes and on the surface of the inclines. The examples and illustrations of this original theory will be found sufficient for application and improvement.

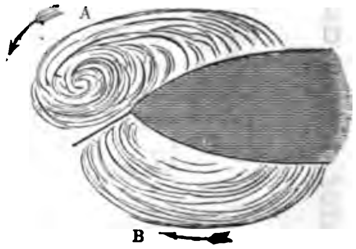


Fig. 4.

In the 5th and 6th Chapters the author offers principles of conic resistance in fluids, which give simple mechanical laws for the class of motions sometimes defined as vortices, eddies, and cyclones. Examples of conic fractures of water, projectile rotation. Whirl and bi-whirl projections produced by various experiments are very fully recorded and illustrated, and the author states "that these mechanical laws may be ultimately shown to be generally, if not the universal, principles upon which all fluids move by displacement upon themselves; which will open out new theories of fluid motion."

Chapter 7 is a continuation of the laws and forces laid down in the two preceeding chapters.

Chapter 8. On the principles of motive projection of free solids in extensive fluids enters a field of work which has received the unremitting attention of such well know theorists on the resistence of bodies moving through deep water, and on various wave theories Mr. Froude, Dr. Woolley, Mr. Scott Russell, Mr. Rankine, and many others with whose ideas and experiments we must at some future time deal and observe how far they work in with those of Mr. Stanley. Figures 1, 2, and 3, represent bodies projected through water at different velocities. Figure 1 is a slow projection with a velocity of slight resistance showing motions of rolling contact having ample time for fluid accommodation in small space to engender thereby a close system of projectile force. Figure 2 is a moderate rate of projection with a velocity of highest relative, resistance for the mass of fluid displaced; the cohesive force upon the vessel being sufficient to engender contact whirls to the greatest possible distance giving the broadest system of projectile whirls. Figure 3 is a rapid projection with a velocity of diminishing resistance, or of fracture of cohesive form, the whirl system being incipient for want of time, the cohesive force partially breaks the liquid and the vessel is set relatively free in proportion to the amount of fracture. Figures 4, 5, and 6, following these experiments shew also the action of water, by the authors whirl system, on rudders at different speeds. As this is a matter of great interest to the MARINE ENGINEER, and has received a large amount of study and observation which to a great extent governs the size and shape of rudders fitted to different vessels we must also deal with this as a special subject on some future occasion. The 1st section of the volume which contains the greater half of the matter given, closes with some facts on diffusion of fluid forces which the author considers may need more experimental demonstrations that he has given.

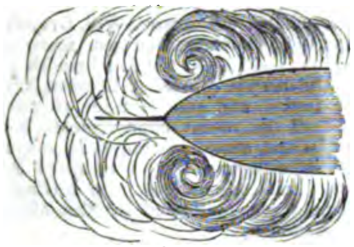


Fig. 5.

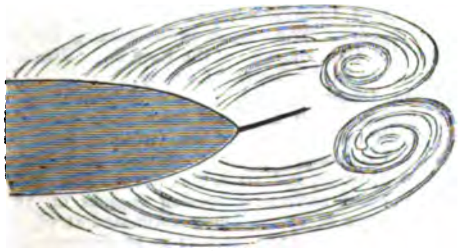


Fig. 6.

The second section of this work is devoted to the discussion of cosmical phenomena in fluids, in some parts following certain ideas proposed by Lenz, Herschel, and Dr. Carpenter. The author having discovered and introduced further principles of motions in fluids, proposes certain universal systems of motions for fluids upon the globe; consistent with the distribution of land and water as it exists, and at the same time as will constantly influence this distribution. These researches may aid in the elevation of the sciences of physical geography and meteorology, now sciences of *observation*, to sciences of *principle*; to rank at some future period with such exact sciences as astronomy and chemistry; but as they are at present proposed, may be considered only the commencement of systematic work in this field of research.

Section 3 on waves contains many experimental inferences which agree most nearly with ideas first published by M. Flangergues, in the *Journal de Sçavans*, 1789, and in some instances assisted by the experiments of Mr. J. Scott Russell. Throughout this section the motion of rolling contact is systematically followed out and worked up to; and, although an original development of ideas and experiment by the author is to a certain extent embodied in his theory of waves, it agrees in many instances with the ideas and experiments of other authorities on this subject, to which, as in the other instances mentioned at some future time, we will give further attention by comparison.

THE close of the year 1881 will be particularly memorable in the annals of the Iron Shipbuilding Trade. This year opened with promising prospects for this branch of industry, which have been in every way most fully realized. The northern and north-eastern districts have reaped the greatest harvest out of the highly improved condition of trade, whilst a steady improvement has also been observable in the usually quiet state of affairs in the southern districts. On the Clyde the shipbuilders' have completed work which exceeds the hitherto well-known year of 1874. At the end of November, 1881, the number of tons completed during the eleven months of the year reaches the large total of 290,000. This is 27,500 tons in excess of the amount completed in 1874, which will be considerably augmented during the month still remaining. The number of vessels launched in November was twenty-four, representing a total of 31,600 tons. In November, 1880, it amounted to 25,410 tons; in 1879 to 20,240 tons; in 1878 to 23,903 tons; in 1877 to 21,000 tons; in 1876 to 30,000; in 1875 to 28,500 tons; and in 1874 to 20,000 tons. Notwithstanding the large amount of work completed, employers are fully occupied, and large orders are still being booked and contracted for. On the Tyne, although the output of work is not on such a large-scale as that of the Clyde, shipbuilders' have experienced a very busy year. In most of the yards the building slips are full, and in many cases orders are waiting in hand for keels to be laid, as soon as space can be obtained by launching. In the Tees district the state of the shipyards is in a highly satisfactory condition, and the year will close in a most succesful manner, which is rendered more encouraging by the prospect of a much more busy year in 1882. Sunderland, Middlesbro', Hartlepool, Shields and Hull, with building and repairing contracts have generally been fully employed throughout the year, and together with the shipbuilding community mentioned, have still better things to look forward to in the future. Liverpool and Birkenhead are enjoying a fair share in the long looked for revival of the shipbuilding trade, and even London (the deserted centre of this industry), Southampton, and smaller seaports in the south, will, at the close of 1881 experience a greater feeling of satisfaction than has fallen to their share for some years past. In recording briefly the shipbuilding progress of the year just closed it is pleasant to find that, together with other interests, this important branch has risen so much from the stagnation which has for some time attended it, and it is a still greater pleasure to be able to look forward to the coming year with hopes of increased prosperity in this direction.

DUNDEE SHIPBUILDING IN 1881.—Dundee has shared in the prosperity which has attended this branch of industry during the past year on the Clyde and elsewhere. During 1881, 11 vessels of 18,945 tons have been launched. Last year 15 vessels of 15,621 tons were completed. Thus it will be seen that though in 1881 there are four fewer ships, the size of the vessels is so much greater that their combined tonnage exceeds by 3,324 the total of 1880. Coming to the work on hand, we find that this year 16 vessels of 21,758 tons are contracted for, while last year at this date 7 vessels of 14,925 tons were ordered—thus showing an increase this year of 9 vessels, or 6,833 tons. The tonnage launched, as also that on hand, is the largest for the last 11 years. Though this year the number of vessels built is scarcely one-half of that in each of the years 1875 and 1876, the total tonnage is very much in excess of the years mentioned, showing clearly the preference which shipowners have for a larger class of vessels. Taking the work of the individual firms, Messrs. Gourlay Brothers & Co. have completed three vessels of 11,169 tons, while they have orders for six of 10,608 tons. Messrs. Alexander Stephen & Sons have launched four vessels of 3,859 tons, and have on hand three of 3,320 tons. Mr. W. B. Thompson have turned out four vessels of 3,917 tons, and has contracted to build seven of 7,830 tons. Messrs. Pearce Brothers, of Lilybank Foundry, have acquired ground for a shipbuilding-yard. Mr. W. B. Thompson has also made application to the Harbour Board for three additional slips. Altogether there seems a prospect of great activity in the shipbuilding trade during 1882.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* The Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed.]

LAUNCHES.—English.

Elise.— On December 3rd there was launched from the shipbuilding yard of Messrs. Joseph L. Thomson & Sons, North Sands, an iron screw steamer of 3,150 tons burthen, built to the order of Messrs. James Gray and partners, of Whitby, for the Indian and Atlantic trades. This vessel has been constructed under special survey, and is of the highest classification at Lloyd's. The engines will be fitted by Mr. John Dickinson, of Palmer's Hill Engine Works, and are 180-horse power nominal; four horizontal steam winches, patent windlass, anchor, crane, Messrs. Cooper & Taylor's steam-steering gear (manufactured by Mr. John Lynn, of Sunderland), fresh water condensers, and all modern appliances for the efficient working of the vessel will be supplied. The naming of the vessel *Elise* was performed by Mrs. Gray, of Whitby.

City of Antwerp.—On December 5th, there was launched from Messrs. J. Blumer & Co.'s Yard, Sunderland, a screw steamer, of the following dimensions:—Length, 200 ft.; beam, 30 ft.; depth, 14 ft. 6 in. She has been built to the order of Messrs. Palgrave, Murphy, & Co., of Dublin and London, and has the highest class at Lloyd's, also Board of Trade passenger certificate. She is on raised quarter-deck principle, and has double bottom throughout for water ballast. Her main deck is of iron, and she is fitted with complete 'tween decks, four powerful steam cranes, and all other arrangements suitable for her intended trade between the Continent and Irish ports. She is to carry 1,000 tons on 13 ft. 6 in. draught, and is intended to steam 11 knots fully loaded. Higginson's steam quartermaster will be fitted for steering amidships, and Davie's patent steering gear aft. Her engines of 120-horse power will be supplied by Messrs. T. Richardson & Sons, Hartlepool, with all their latest improvements. On leaving the ways she was named *City of Antwerp* by Mrs. Lamont, wife of Captain Lamont.

Lavion.—On December 5th, a screw steamer for La Société Francaise des Steamers de l'Ouest (Messrs. Menier & Co.) was launched from the yard of Messrs. Schlinger, Davis & Co., Wallsend:—Length, 260 ft.; breadth, 33 ft. 6 in.; depth, 20 ft. 6 in. She will be classed 100 A 1 at Lloyd's. She has been built under the inspection of Lloyd's Surveyor on behalf of the owners. As she left the ways she was named the *Lavion.*

Antverpia.—On December 6th, Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, launched an iron screw steamer, 295 by 37 by 25, built for the Société Anonyme Anversoise d'Armement et de Transports Maritimes. The vessel was named *Antverpia* by Mrs. G. B. Hunter. She is intended for the East Indian trades, and will carry about 3,300 tons dead weight. The vessel will be fitted with engines of 35 and 68-45, made by the Wallsend Slipway and Engineering Company (Limited).

James Whishaw.—On December 6th, Messrs. M. Pearse & Co. launched at Stockton-on-Tees, an iron screw steamer, of the following dimensions:—Length, 250 ft.; breadth, 34 ft.; depth, 19 ft. 6 in. This vessel is about 1,600 tons gross register, and will carry about 2,150 tons dead weight. She will be classed 100 A 1 at Lloyd's; has short full poop aft, in which is fitted a saloon with the usual accommodation; has double bottom for water ballast; will be rigged as a two-masted schooner; has four steam-winches, and all the most recent and improved appliances for expeditiously loading and discharging cargoes. Her engines are of 150-horse power nominal, by Messrs. Blair & Co., of Stockton. This steamer has been built to the order of Messrs. Tulley & Co., of Hull, and is the fourth Messrs. M. Pearse & Co. have built for the same owners. As she left the ways she received the name of *James Whishaw*, from Mrs. R. G. Johnson, of Beverley, daughter of the managing owner.

Dauntless.—On December 6th there was launched from the yard of Mr. J. T. Eltringham, Stone Quay, South Shields, an iron paddled tug. Her dimensions are 108 ft. by 18 ft. 9 in. and 10 ft., and she will be fitted with a pair of surface condensing disconnecting engines of 70-horse power. This vessel, which is named the *Dauntless*, and has been built to the order of Messrs. J. P. Rennoldson & Sons, who are the makers of the engines, and is owned by the Waterford Steamship Company (Limited), of Waterford, by whom she will be employed in towing and passenger services.

North Cambria.—On December 6th there was launched from Messrs. Palmer's, Shipbuilding and Iron Company (Limited) yard, at Howden, an iron screw steamer of the following dimensions: — Length, 270 ft.; beam 36 ft.; depth, 24·6. She has been built to the order of Messrs. Hugh Roberts & Son, of Newcastle-on-Tyne, on the principle of cellular construction, having water ballast tanks fore and aft, forming a double bottom the whole length of the ship. She has long bridge, poop and topgallant forecastle; four steam winches, patent steam steering gear, steam starting and reversing gear, and all the latest improvements in hull and engines; classed 100 A 1 at Lloyd's, having been built under special survey, and will carry about 3,000 tons deadweight; is intended for the American, Indian, and general trades. The vessel as she left the ways was christened *North Cambria* by Mrs. Griffith Roberts, wife of the junior partner of the firm of Messrs. Hugh Roberts & Son.

Everest.—On December 6th Messrs. Wm. Gray & Co. launched from their yard at West Hartlepool an iron screw steamer, of the following dimensions:—Length, 262 ft.; breadth 34·6 ft.; depth, 19·8 ft.; built to the order of Murrell & Yeoman, West Hartlepool, intended for the Indian and general trade, to carry 2,400 tons. She is fitted with all the recent improvements, including double bottom for water ballast, steam stearing-gear, steam winches, and patent windlass. The engines are to be fitted by Messrs. Blair & Co., Limited, Stockton-on-Tees. On leaving the ways the christening ceremony was performed by Mrs. Murrell, the vessel being named the *Everest.*

Lynx.—On December 8th a fishing smack, cutter-rigged, was launched from the shipbuilding-yard of Messrs. John & Daniel Dewdry Brothers, Brixham. She is owned by Mr. W. Furneaux, of Brixham, her tonnage being 43 tons register, and she is named the *Lynx.* She is intended for the Brixham fishery.

Victoria Regina.—On December 10th Messrs. Oswald, Mordaunt & Co. launched from their shipbuilding and engineering works, Southampton, an iron sailing ship of 2,000 tons register, named the *Victoria Regina*, built to the order of John Coupland, Esq., Goscote Hall, Leicester, of the following dimensions:—Length 270 ft.; breadth, 39 ft. 6 in.; depth of hold, 24 ft. The ship is built with full poop, monkey forecastle, and large midship house for crew. She is fitted with Harfield's patent windlass for lifting anchors, and all the latest improvements. She is intended to class 100 A 1 at Lloyd's, and twenty years in the Liverpool Underwriters' registry. The ceremony of naming the vessel was performed by Mrs. Caussey, wife of the Captain. When fitted out she will be commanded by Captain Caussey.

Zodiac.—On December 10th Earle's Shipbuilding and Engineering Company, Hull, launched from their yard the steamship *Zodiac*, built to the order of the Grimsby and North Sea Steam Fishing Company (Limited). She is 92 ft. between perpendiculars, 20 ft. beam, and 10 ft. 6 in. deep. She will be propelled by compound surface-condensing engines of 35 nominal horse power, her rate of speed being estimated at 9¼ knots per hour. Her cylinders are 17 in. and 32 in. in diameter, whilst the stroke is 18 in. The steamer when launched not only had her masts and rigging in position, but her engines and boilers were also on board.

Sultana.—On December 19th, there was launched from the shipbuilding-yard of Messrs. Robert Thompson & Sons, Southwick, Sunderland, an iron screw-steamer, built for John Redfern, Esq., of Hull, of the following dimensions, viz.:—Length over all, 300 ft.; breadth, 35½ ft.; and depth of hold, 23 ft. 9 in. The vessel has been constructed to class 100 A 1 at Lloyd's under the three-decked rule. She has water ballast throughout both holds, five watertight bulkheads, iron main and wood upper deck, and is fitted as a two-masted schooner with double topsails. The poop aft is fitted up with accommodation for the captain and spare berths, bridge amidships for officers, topgallant forecastle for firemen and crew. She is fitted with four steam winches and donkey boiler to work four large hatchways, Emerson, Walker & Co.'s patent windlass, patent steam steering gear by Amos & Smith, Hull, screw gear aft, and all the latest improvements, and will also have engines 37 and 68 by 42-in. stroke, with two very large boilers 80 lbs pressure, by the North-Eastern Marine Engineering Company, South Dock, Sunderland. As the vessel left the ways she was christened the *Sultana*, by Mrs. Frost, wife of the Captain.

Gulf of St. Vincent.—On December 21st, Messrs. Wm. Gray

& Co. launched from their yard an iron screw-steamer of the following dimensions:—Length over all, 300 ft.; breadth, 38 ft.; depth, 27 ft. 3 in.; built to the order of the Greenock Steamship Company, Greenock, and intended for general trade, to carry 3,500 tons. The vessel has been built under the personal supervision of Captain Cook, the superintendent for the company. She has spacious 'tween decks for carrying horses or cattle, and is fitted with all recent improvements, including steam steering gear amidship, screw gear aft, and Napier's steam windlass and steam winches; she is fitted with a double bottom entire on the cellular principle, and is in other respects extra strong beyond Lloyd's requirements for the highest class, having two strokes double on topsides and two extra watertight bulkheads; the main and spar decks are of iron, the latter being covered with teak. The engines are to be fitted by Messrs. Blair & Co. (Limited), Stockton-on-Tees, of very high power, as the vessel is intended to be a fast sailer, her lines being fine. The christening ceremony was performed by Mrs. Lawrence, of the firm of Westcott & Lawrence, the London agents of the Company, the steamer being named *Gulf of St. Vincent*, and is to be commanded by Captain Swan.

Foscolino.—On December 21st, the first screw-steamer, built to the order of the Wear Steamship Company (Limited), of which Messrs. Wrightson & Sayers are the managers, was launched from the yard of Messrs. Pickersgill, Southwick. The following are the dimensions of the vessel, which was christened the *Foscolino* by Mrs. Wrightson:—Length over all, 230 ft.; breadth, 31 ft.; depth, to floor of roof, 15 ft. 6 in.; deadweight carrying capacity, about 1,400 tons, on 15 ft. draught of water. The steamer has iron decks, topgallant forecastle, break from aft to bridge four iron bulkheads with shifting-boards complete, and water ballast tanks in fore and aft holds. She will be fitted with a steam winch to each hatchway, three in number, patent windlass, and a full outfit, including all the most recent improvements. Her engines which will be supplied by Messrs. G. Clarke, of Southwick, are to be on the compound surface condensing principle, with cylinders 27 and 50 in. diameter, and 36 in. stroke. The nominal horse power will be 100, and the effective 500, and the boilers are to work to 75 lbs. pressure.

Roxburgh.—On December 21 there was launched from Messrs. Palmer's Shipbuilding and Iron Company's (Limited) yard, at Jarrow-on-Tyne, an iron screw-steamer of the following dimensions:—Length, 290 ft.; beam, 37 ft.; depth, 24½ ft. She has been built to the order of the Caledonian Steamship Company (Limited), on the principle of cellular construction, having water ballast tanks fore and aft, forming a double bottom the whole length of the ship. She has long bridge, poop, and topgallant forecastle, four steam winches, patent steam steering gear, steam starting and reversing gear. She is to be fitted with a pair of Messrs. Palmers' surface-condensing engines, with cylinders 36 and 68, stroke 42, with large boiler power to work up to 80 lbs. pressure. Has all the latest improvements in hull and machinery, classed 100 A 1 at Lloyd's having been built under special survey. Will carry about 3,300 tons deadweight. Is intended for the American, Indian, and general trades. She is a sister ship to the *Rothesay* (s) and *Renfrew* (s), all built by Messrs. Palmers for this company.

Minard Castle.—On December 21st Messrs. Raylton Dixon & Co. launched from the Cleveland Dockyard, Middlesbrough, another steamer, which is the second they have built to the order of Messrs. Thomas Skinner & Co., of London and Glasgow, and will form one of their well known Castle Line to China. The *Minard Castle*, as the present vessel has been named, will carry nearly 4,000 tons of tea, and her dimensions are: 332 ft. extreme length, 38 ft. beam, 27 ft. 4 in. depth moulded, and about 2,600 tons gross register. Her decks, rails, and fittings, are entirely of East India teek, and her passengers will be accommodated in a deck-house aft. She is fitted with Harfield's patent steam windlass, and Bow and M'Lachlan's steam-steering gear. The engines, of 300-horse power nominal, are being constructed by Messrs. Thomas Richardson & Sons, of Hartlepool. On leaving the ways she was christened the *Miuard Castle* by Mrs. Freek.

Elk.—On December 21st there was launched from the shipbuilding yard of Messrs. Osborne, Graham & Co., Hylton, Sunderland, an iron screw steamer of the following dimensions:—Length between perpendiculars, 245 ft.; beam, 34 ft.; depth, 17 ft. The vessel is built to Lloyd's highest class, and fitted with all the latest improvements. The engines will be supplied by Messrs. Blair & Co., of Stockton; cylinders, 31 in. and 58 in. diameter, and 36 in. stroke. The steamer was named the *Elk*, and is the third vessel of similar dimensions built for the owners, Messrs. Corry, Lohden & Jacksons, of London.

Sutlej.—On December 22nd, the Peninsular and Oriental Steam Navigation Company's new steamer *Sutlej* was launched at Barrow-in-Furness. The *Sutlej*, like a sister ship, the *Ganges*, which was launched in October last, is built of steel, is of 4,100 tons gross register, and will have engines of about 5,000-horse power indicated. She is 390 ft. long; has 42 ft. beam; is 35 ft. deep, and will carry over 3,000 tons of cargo. The *Sutlej*, together with the *Ganges*, will be utilized for the India, China, and Australian mail services.

Ahdeck.—On December 22nd Messrs. Short Brothers launched from their shipbuilding yard at Pallion, Sunderland, a screw steamer, built to the order of Messrs. Walker & Butchart, Sunderland. The following were the dimensions:—Length between perpendiculars, 245 ft.· breadth, 34 ft. 6 in.; and 18 ft. 6 in. depth of hold; with a deadweight carrying capacity of 2,050 tons. She is built to Lloyd's highest class under special survey, and is constructed with a short poop for accommodation of captain, officers, &c. She has long raised quarter deck; bridge house over engine and boilers; and top-gallant forecastle, the latter comfortably fitted up for the accommodation of the crew, and the engineers are berthed in a large house on the quarter-deck. The vessel has iron decks throughout, except poop-deck. There are four large cargo hatches and steam winches, with large donkey boiler; water ballast in fore and after holds; Higginson's steam quarter-master amidships; Harfield's patent windlass, steel warps and tow-lines; with all the latest improvements for quick loading and discharging. She is to be fitted with engines and boilers of 140-horse power by the North-Eastern Marine Engineering Company, Sunderland, with all the latest improvements in marine engineering. On leaving the ways the vessel was named the *Ahdeck;* the ceremony of christening being performed by Mrs. Walker, wife of one of the managing owners.

Elginshire.—On December 22nd Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron-screw steamer of the following description:—Length b.p. 285; beam extreme, 36; depth moulded, 25·2; having a deadweight carrying capacity of about 3,000 tons. This vessel has been built to the order of Messrs. Turnbull, Martin & Co., of Glasgow, under the superintendence of their engineer, Mr. J. Wotherspoon, and is, as near as possible a duplicate of the Ross-shire (s), launched by Messrs. Edward Withby & Co., for the same firm in April last. She is built to Lloyd's highest class as a three-decked cargo-boat, with iron main and wood upper deck, and web frames in lieu of hold beams. She will be rigged as a three-masted topsail schooner, with iron pole masts, iron engine skylight, four winches, and donkey boiler, patent windlass, steam steering-gear, and double-bottom, fore and aft, on the cellular principle. On leaving the ways the steamer was named the *Elginshire*, by Miss Withy. This launch completes a total for the year of eleven steamers and 18,408 tons. All were built on the cellular principle, which reduces the gross tonnage to about 6 per cent.

Borneo.—On December 23rd Messrs. Campbell, Mackintosh, & Bowstead launched from their shipbuilding yard at Scotswood another steamer, named the *Borneo*, which is built to the order of Messrs. E. Boustead & Co., London, for Captain Ross, of Singapore, and is intended for trading in the East. Her dimensions are as follows:—Length (extreme) 190 ft.; breadth, 26 ft. 2 in.; depth, 14 ft. She is built to class 100 A 1 at Lloyd's. Her engines are by Messrs. T. Clark & Co., Elswick, and are 100 nominal and 500 effective horse power. She has three steam winches by Messrs. Clarke, Chapman, & Gurney, of Gateshead, and one of Emerson & Walker's patent windlasses. She has been built under the superintendence of Mr. Allan, the owner's engineer, and will be commanded by Captain Vincent. The christening was performed by Mrs. Allan, wife of the gentleman who had superintended the building. The vessel was most successfully launched in the presence of a number of ladies and gentlemen. The company present adjourned to the offices of the builders, where the usual toasts were proposed.

Huntingtower.—On December 23rd, the *Huntingtower*, an iron screw steamer built for Messrs. Stumore, Weston & Co.'s Tower Line, was launched from Messrs. Wigham Richardson & Co.'s yard at Low Walker, on Tyne. The extreme dimensions are:—Length, 310 ft.; breadth, 37 ft. 3 in.; depth, 29 ft. 6 in. moulded. She is classed 100 A 1 at Lloyd's under special survey, and will carry a passenger certificate; her hull, machinery, boilers, and outfit being Board of Trade survey, and to their requirements for passenger steamers. The water ballast is fitted so as to occupy none of the space in the cargo holds, which are of a cubic measurement capacity of 4,250 tons, exclusive of 250 tons of permanent bunker space. The total dead-weight carrying capacity is 3,650 tons. The frames are carried up, plated over, and decked in for a length of 80 ft. amidships, forming a protection to the engine-room and stoke-hole casings, officer's rooms, &c., in heavy weather. Steam stearing gear, is fitted in the bridge wheelhouse, and powerful screw gear in the after wheelhouse. Chadbourn's reply telegraph is fitted from the bridge to both after wheelhouse and engine room. The cargo hatches are worked by four large horizontal steam winches, and both anchors by a powerful crane and Emerson Walker's patent windlass. A saloon with accommodation for 20 first-class passengers, is fitted up in an iron deckhouse aft, and communication with the 'tween decks arranged, so that a large number of passengers could be accommodated should the ship be employed in the passenger service. The engines are compound and by the builders of the ship, diameter of cylinders 35 in. and 73 in.; stroke of piston 48 in., indicating 1,300 horse-power, and supplied by steam at 90 lbs. pressure, from two large double-ended steel boilers. This is the fifth steamer built by Messrs. Wigham Richardson, for the Tower Line, and they have three more large steamers, in different stages of construction, for the same owners, and all of which will be completed before the middle of the ensuing year.

Douglas.—On December 26th there was launched from the building-yard of Messrs. Hall, Russell, & Co., Footdee, an iron screw steamer of the following dimensions:—Length, 256 ft.; breadth, 34½ ft.; depth, 24 ft.; and 1,588 gross tonnage. The vessel, which was named the *Douglas*, and which has been built under special survey to class 100 A 1 at Lloyd's, will be fitted with compound surface-condensing engines of 240-horse-power nominal, and will have steam winches, patent steam windlass, steam steering gear, iron masts, water ballast, and all the most approved appliances for facilitating the loading and discharging of cargo. The *Douglas* has been built to the order of Messrs. Douglas, Lapraik, & Co., Shipowners, London and China, under the immediate superintendence of Captain Ashton, by whom she is to be commanded. She is specially intended for the China trade, and has accommodation for 50 first-class, 160 second-class, and 23 steerage passengers, for whose comfort and convenience admirable provision has been made. The ceremony of christening the vessel was performed by Miss Cooper, Craiglebuckler. The *Douglas* was afterwards towed to the shear-poles, for the purpose of receiving masts and machinery, &c.

Ashford.—On December 27th a screw-steamer, built to the order of the Standard Steamship Company (Limited), was launched from the shipbuilding-yard of Messrs. J. L. Thompson & Sons, North Sands, Monkwearmouth. The ceremony of christening was performed by Mrs. H. Wrightson, who named the vessel the *Ashford*. The dimensions of the steamer, which will be schooner-rigged, are as follows: Length, 275 ft.; breadth, 37 ft. 6 in.: depth, 19 ft. 6 in., and she has been built under special survey to class 100 A 1 at Lloyd's. Four hatches are provided, with a steam winch to each, patent steam windlass, steam gear, and all the latest improvements connected with the fitting of a steamer will be utilized. Mr. J. Dickinson, of the Palmer's Hill Engine Works, will fit in engines of 180-horse power nominal, with cylinders of 34-in. and 64-in. diameter, and 42-in. stroke. The boilers will bear a pressure of 80 lbs. to the square inch. This is the tenth steamer built by the firm this year.

LAUNCHES.—Scotch.

Francis Grenier.—On November 25th, Messrs. Scott & Co., Shipbuilders, Cartsdyke, launched a steamer of 308 tons burthen, for the French mail service in Cochin China. As she left the ways she was named the *Francis Grenier*. She is to be supplied with engines of 60-horse power.

Dacca.—On November 25th, Messrs. A. & J. Inglis Pointhouse, launched a steel screw-steamer of 4,100 tons, for the British India Association Line. She was named the *Dacca*, by Miss Inglis, and is the largest owned by this company. Her dimensions are—390 ft. by 43 ft. by 29 ft. to spar deck, and her engines are 3,200 indicated horse power. All the passenger accommodation is on deck, the first-class passengers being located in a midship-house about 200 ft. long, the saloon occupying the forward part. The second-class cabins are aft, also in a deckhouse, so that the entire space under the spar deck is available for coal and cargo, with the exception of the engine-room and stokers' berths. The *Dacca* is intended to sail from London for Calcutta in April next.

Remus. — On December 6th, Messrs. H. M'Intyre & Co. launched from their shipbuilding yard at Paisley the *Remus*, an iron screw steamer of 1,100 tons. The *Remus* is a sister ship to the *Mindinao*, built by Messrs. M'Intyre & Co. in August, and is for the same owner, namely, Captain Wm. Watt, Helensburgh. She is awning-decked, classed 100 A 1 at Lloyd's, and fitted out in the most complete manner as a passenger and cargo steamer, with all the latest improvements in hull and machinery. Her engines are being constructed by Messrs. Hutson & Corbett, Glasgow. The ceremony of naming was performed by Mrs. John Lochead, Row Bank, Helensburgh.

Athenian.—On December 7th, Messrs. Aitken & Mansel, launched from their premises at Whiteinch, Glasgow, the new steamship *Athenian*, built for the Union Company, and making the thirty-ninth vessel owned by that company since they began the mail service between England and the Cape Colonies in 1857. The dimensions of the *Athenian*, are as follow:—Length between perpendiculars, 365 ft.; beam, 45 ft. 6 in.; depth, 32 ft. 6 in.; and her gross estimated tonnage is about 4,000 tons. Her engines are by Messrs. John & James Thompson of Finnieston Street, the parts which have to bear the principal strain being of unusual size and weight; while the shafting is made of steel by Messrs Vickers, of Sheffield. The cylinders are 50 in. and 94 in. diameter; length of stroke, 54 in., and estimated horse-power, 3,500. The vessel is built with a double-bottom, and on the cellular system, and all the bulkheads on the main deck are fitted with massive iron doors, which are watertight and fireproof. All her boats are fitted with Hill & Clarke's patent lowering apparatus, and six of them are lifeboats, capable of carrying a large number of people. The *Athenian*, which is provided with every modern appliance for safety and comfort, is three-masted, schooner-rigged, and her masts are of iron. She will carry 150 first-class passengers, 50 second, and 120 third.

Clutha.—On December 7th, Messrs. Barr & Shearer, Ardrossan, launched a three-masted barquentine, the dimensions of which are as follows:—Length, 162 ft.; breadth, 24 ft. 6 in.; depth, 12 ft. 10 in. She is 246 tons nett register, is owned by Messrs. Munn, Newfoundland, and is intended for the Brazil trade. On leaving the ways she was named the *Clutha*, the ceremony being performed by Miss M'Call.

Siren.—On December 9th, Messrs. Barclay, Curle, & Co., launched from their yard at Whiteinch, the *Siren*, an iron sailing ship of 1,560 tons register, for Messrs. A. & J. H. Carmichael & Co., Greenock. The usual ceremony of naming was performed by Miss Arthur, Finsbury Park, London.

Mouhout.—On December 9th, Messrs. Scott & Co., Cartsdyke, Greenock, launched an iron screw steamer of 308 tons burthen, with engines of 60-horse power. On leaving the ways she was named the *Mouhout*. She is similar in every respect to the four steamers already launched by Messrs. Scott for a French firm, and she is to be employed in connection with the French mail service in Cochin China.

Rydal Fell.—On December 17th, Messrs. Murdoch & Murray launched at Port Glasgow an iron screw steamer of the following dimensions:—Length, 180 ft.; breadth of beam, 26 ft.; depth of hold, 14 ft. 3 in; of 600 tons gross. This vessel has been built for Messrs. Hume, Smith & Co., Liverpool, and is to be engaged in the Mediterranean trade. As she left the ways the ceremony of naming the steamer the *Rydal Fell* was performed by Mrs. Hume, wife of one of the owners. After the launch the vessel was towed to Glasgow, where Messrs. Dunmore & Jackson will supply her with engines of 80-horse power.

Torch.—On December 19th, Messrs. Robert Duncan & Co. launched from their yard at Port Glasgow, a twin-screw tug and tender for the Clyde Lighthouses Trustees, to be used in connection with their gasworks, for filling the buoys with gas, &c. Her dimensions are:—Length, 95 ft.; breadth of beam, 21 ft.; depth of hold, 7 ft. 6 in. Two very powerful cranes have been fitted on board. Messrs. Rankin & Blackmore, Greenock, will supply a pair of their patent disconnecting twin-screw engines of 260 indicated horse power. As she left the ways she was named the *Torch* by Miss Jennie Duncan, daughter of Mr. Robert Duncan.

Chiloe.—On December 19th Messrs. John Elder & Co. launched from their shipbuilding and engineering works at Fairfield, an iron screw steamer, built for the Pacific Steam Navigation Company, for their trade on the West Coast of South America. The vessel 320 ft. long, 37 ft. beam, 25 ft. depth of hold, and of about 2,100 tons gross. She is classed in the Liverpool Underwriters' Registry in the highest grade, and is built on the cellular double-bottom system. The engines, which are supplied by the builders of the vessel, are compound and 2,500-horse power, and are expected to drive the vessel fully 15 knots an hour on trial. The high-pressure cylinder is 42 in., and the low-pressure cylinder 80 in. diameter by 4 ft. stroke, steam being supplied by two double-ended boilers of the usual type of 100 lbs. pressure. Accommodation has been provided in the vessel for 100 first-class passengers, with the dining saloon on upper deck and on promenade deck on top. She is also fitted up for carrying cattle on deck, and has the usual steam appliances for working cargo, steering the vessel, pumping, &c. On the vessel leaving the ways she was named the *Chiloe* by Miss Mitchell, daughter of Moncrieff Mitchell, Esq., of Newmains.

Bucarest.—On December 20th the French mail steamer *Bucarest*, sister vessel to the steamers *Galatz* and *Ibrail*, recently built by Messrs. A. M'Millan & Son, Dumbarton, was launched by that firm. This vessel is to form one of the Messieurs. Fraissnet & Cie's line of mail and passenger steamers in the Mediterranean, Black Sea, and Danube, and is fitted with every comfort for passengers, and all the most superior arrangements for loading and discharging of the cargo with the utmost despatch. The *Bucarest* is 1,800 tons register, and will be furnished with engines of 1,400-horse power by Mr. D. Rowan, Glasgow.

Manapourie.—On December 20th, Messrs. Wm. Denny & Brothers launched from the Leven Shipyard, Dumbarton, the *Manapourie*, a steel crew-steamer, about 1,830 tons gross, for the Union Steamship Company of New Zealand (Limited). The name *Manapourie*, which was conferred on the vessel by Miss Denny, of Helenslee, daughter of Mr. Peter Denny, senior partner of the firm of Wm. Denny & Brothers, is of one of the numerous lakes in the province of Otago, and is adopted in pursuance of a systematic appropriation of the names of New Zealand lakes for this Company's vessels. The dimensions of the vessel are:—Length between perpendiculars, 283 ft.; breadth, moulded, 36 ft.; depth, moulded, 25 ft. She has been built of Siemens-Martin steel, under special survey of Lloyd's, and classed in their registry 100 A 1, three-decked, her bottom being constructed on the cellular and deep-floored princible and adapted for water ballast. She will be fitted for 136 first-class passengers and 117 second-class, while portable accommodation for a number of third-class passengers will be provided in 'tween decks. The vessel will be fitted by Messrs. Denny & Co. with compound surface-condensing engines of 2,000-horse power indicated, the cylinders being 41 in. and 70 in. diameter.

Orion.—On December 20th, Messrs. Caird & Co., Greenock, launched from their shipbuilding-yard a screw-steamer of 2,000 tons, for Austrian-Lloyds (Trieste), and to be employed in the China trade. Her dimensions are as follow:—Length, 340 ft.; breadth, 38 ft.; and depth, 28 ft. After the launch, the steamer, which had been named the *Orion*, was taken to the Victoria Harbour, where her engines and machinery will be put on board.

Belgravia.—On December 20th Messrs. David and William Henderson & Co. launched from their shipbuilding-yard, Meadowside, Partick, a three-decked iron screw steamer, built to the order of Messrs. Henderson Brothers, having the following dimensions:—Length, 400 ft.; breadth, 44 ft. 6 in.; depth, 33 ft.; gross tonnage, 5,000 tons. She will be supplied by the builders with engines of 1,047-horse power nominal, and will be fitted with all the latest improvements for the comfort and safety of passengers, and for the speedy loading and discharging of cargo. Accommodation has been provided in the main and 'tween decks for steerage, and on the upper deck for saloon passengers. As the vessel left the ways she was named the *Belgravia*, by Miss Clara Henderson, Westbank, Partickhill. The *Belgravia*, when completed, will be placed on the Anchor Line service between London and New York.

Austral.—On December 21st was launched from the yard of Messrs. John Elder & Co., at Govan, a screw-steamer, named the *Austral*, and intended for the Australian passenger trade of the Orient Steam Navigation Company. Her dimensions are:—Length over all, 474 ft.; breadth, 48 ft.; depth, 37 ft.; displacement, 9,500 tons. Her engines are of the three-cylinder type, capable of developing 6,300-horse power, and she is therefore expected to be very fast. Accommodation is provided on board for 120 saloon, 130 second-class, and about 300 intermediate and steerage passengers. The *Austral* is built wholly of steel, and will take the highest class at Lloyd's. She is built upon the double-bottom principle, and is divided into 13 water-tight bulkheads, 10 of which run up to the height of the main deck. Above the main deck she is divided into seven fire-proof divisions by stout steel bulkheads, and ample provision is made for a full supply of water in all parts in case of fire. The *Austral*, as compared with the *Orient*, is 10 ft. longer. of 2 ft. greater beam, and of the same depth.

Sorrento.—On December 21st, there was launched from the shipbuilding yard of Messrs. Alex. Stephen & Sons, Linthouse, Govan, an iron screw steamer of about 2,400 tons, built under special survey to class 100 A 1 in Lloyd's. This vessel forms the latest addition to the fleet of Messrs. Robert M. Sloman & Co., of Hamburg, and is for their Hamburg, London, and Australian Line. She has been fitted up with all the most recent appliances for loading and discharging cargo, and working the ship. In common with the other ships of this line, she has been provided with a meat chamber and refrigerating machinery, for the conveyance of dead meat from the Colonies. Her engines have cylinders 38 and 68 diameter, by 42 stroke, and (according to Messrs. Stephen's usual practice) were fitted on board before launching. The ship on leaving the ways, was named *Sorrento* by Miss Alice Templeton, Park Circus, and immediately thereafter was taken to the harbour to receive cargo, when she is expected to sail for Hamburg next week. The *Sorrento* is the twelfth ship which Messrs. Stephen, have built for these owners, for whom they have at present on hand two other steamers.

Quiraing.—On December 22nd, Messrs. Blackwood & Gordon, launched at Port Glasgow, a screw steamer of the following dimensions:—Length, 220 ft.; breadth of beam, 31 ft.; depth of hold, 21 ft.; and 1,250 tons gross. This steamer has been built for the Australasian Steam Navigation Company, and has accommodation for 60 first-class and 100 second-class passengers. She is brig-rigged, is supplied with a water-tank of 400 tons, has a half-length shelter deck, and is replete with all the most modern improvements. The stearing gear has been manufactured by Messrs. Bow & M'Lachlan, Paisley, and four steam winches by Messrs. Napier, Brothers, Glasgow. The engines are 200 horse-power nominal, supplied by the builders, and the steamer is expected to attain a speed of not less than 14 knots. The ceremony of naming the new vessel the *Quiraing*, was performed by Mrs. Storer, Glasgow.

Merton Hall.—On December 22nd the screw steamer, *Merton Hall* was launched from the Camperdown Shipbuilding-yard, Dundee. She is a steel steamer of 4,178 tons gross register. Her extreme length is 411 ft., or 400 ft. between perpendiculars; extreme breadth. 12 ft. 3 in.; depth of hold, 29 ft. 6 in. The *Merton Hall* has been built and engined by Messrs. Gourlay Brothers & Co., to the order of Messrs. Alexander & Radcliffe, of Liverpool, for their Hall Line of steamers, which run between Liverpool and Bombay. The *Merton Hall* will have the highest class at Lloyd's, and everything will be done to fit her for the service intended. Besides the large engines for driving the vessel, there will be eight pairs of double engines, and two single ones. These will be employed in steering the vessel, lifting the anchors and cargo, and pumping water. The steering engine will be placed far aft, so that passengers may not be disturbed by it.

Hansa.—On December 22nd Messrs. James and George Thomson launched from their yard at Clydebank a screw steamer of 700 tons, for the Hamburg-American Steam Packet Company, of Hamburg, intended to serve as a passenger tender for this company's service. The vessel, which was named *Hansa* by Miss Leitke, of Glasgow, will be supplied with engines by the builders, who are building for the same Company a magnificent liner of 5,000 tons and 5,000-horse power.

B. Kemeny.—On December 24th there was launched from Lower Yard, Dumbarton, an iron screw steamer of the following dimensions: Length, 245 ft. by 35 by 17. She has been built to the order of the Adria Steamship Company, and is fitted with all the latest improvements. As she left the ways she was named the *B. Kemeny* by Mrs. Burrell, wife of the managing owner.

LAUNCH.--GERMAN.

Deuteros.—The s. s. *Deuteros* was launched on November 26th from the yard of the Flensburg Shipbuilding Company; built to the order of the Flensburg Steam Navigation Company of 1869. She is a spar-decked vessel, and is of the following dimensions:—258 ft. by 34 ft. by 24 ft. 10 in., and will be fitted with compound engines of 160 nominal horse power. She was christened by Miss Hansen, daughter of the managing owner. She is now at the shear legs getting her engines put in, and will be finished in about four weeks.

LAUNCH.—SWEDISH.

Hoen.—On December 20th there was launched from the yard of the Motala Company at Lindholmen, a screw steamer of the following dimensions.—Length, 148 ft.; breadth, moulded, 23 ft.; Depth of hold from top of keel, 10 ft.; height between decks, 7 ft. 3 in. This vessel was named *Hoen*, and is built of Motala puddle iron and Bessemer steel; the keel, stern, sternpost, framing and plating being of puddle iron. The *Hoen* is intended for the mail and passenger route in Oresund between Denmark and Sweden, and is the seventieth vessel her owners, "Det forenede Dampskib Selskab," in Copenhagen, have afloat. She will immediately receive her engines of 100 nominal horse power.

TRIAL TRIPS.

Wandrahm (s. s.)—On November 22nd, the (s. s.) *Wandrahm* built and engined by the Flensburg Shipbuilding Company, to the order of the Steam Navigation Company, "Hansa" in Hamburg, ran her trial trip in the Flensburg Bay. The *Wandrahm* is a spar-decked vessel and is of the following dimensions:—258 ft.; by 34 ft.; by 24 ft. 10 in. and is fitted with engines of 160 nominal h. p. She is calculated to carry about 2,200 tons deadweight. She is a fine looking vessel and is splendidly fitted out with all the newest improvements. The cabin for accommodating the captain, officers, and a few passengers is placed amidships and is kept in an elegant style with polished hardwood and neat carved ornaments. The upper deck is laid with prime "East India" teakwood. At the trial everything worked to the entire satisfaction of the Owners, she obtaining a speed of 11 knots per hour.

India.—The last addition to the fleet of the British India Steam Navigation Company is a powerful steel steamer called the *India*, constructed by Messrs. William Denny & Sons, of Dumbarton. The registered tonnage of this ship is 4,065 tons, and the dimensions are:—Length, 390 ft.; breadth, 42 ft.; and depth, 31 ft. She is propelled by engines of 3,000 indicated horse power, and maintained on trial a mean speed of 14½ knots. She is divided by water-tight bulkheads. She is a flush-decked steamer, but carries the greater number of her first-class passengers in a citadel house, extending for about 140 ft. amidships, and enclosing all the vital openinings of the machinery spaces. The saloon and passengers' cabins are lighted with Swan's electric lights. In addition to the ordinary saloon, there is a music-room for ladies, a smoking and reading-room for gentlemen, and a mess-room for children and nurses, and she is provided with Gifford's refrigerating gear for the preservation of fresh meat. The *India* sailed from Gravesend for Colombo, Madras, and Calcutta, after embarking 80 cabin passengers.

Grafton (s.s.)—On December 3rd the fine new screw steamer. *Grafton*, built to the order of Messrs. F. W. Morgan & Co., London, by Mr. R. Thompson & Sons, Southwick, proceeded from this port to London, after a most satisfactory trial. The vessel, which was only launched four weeks ago, is of the following dimensions: Length, 270 ft.; breadth, 36 ft.; depth of hold, 24 ft. 6 in.; 1,150 tons net register, and 1,800 tons gross. She has been specially fitted with the most improved machinery for the East Indian carrying trade, including patent steam steering gear by Mr. C. R. Simey, of Sunderland; four steam-winches (one for each hold) by Messrs. Welford & Wigham, of Sunderland; steam or hand windlass; patent waterwitch which pumps for the hold by Messrs. Downton, patent gangways, and two steelwire hawsers of exceptional strength. She has been built on the cellular water ballast system fore and aft, and is also provided with six watertight bulkheads, which is much in excess of the average number. The boats, four in number, are fitted with Sample & Ward's patent detaching gear, by means of which they can be immediately brought into use, and the steamer is also provided with compasses of extra quality, and with Sir William Thompson's sounding machine. Intended to trade in Eastern climes, the comfort of the officers and crew has received special attention, extra ventilators having been fitted, while the berths have been made as comfortable as possible. The cabin, handsomely fitted, and berths for the captain and officers are aft, the engineers' rooms amidships, while the seamen and firemen are located in a large forecastle forward. There is also a chart house and smoke-room on deck. The engines, fitted by Mr. George Clark & Sons, Southwick, are on the compound surface-condensing principle, with cylinder of 34 in. and 64 in. diameter, 42 in. stroke, and during the trial worked up to 1,000 indicated horse-power. The *Grafton* left the dock with upwards of 2,400 tons of coals on board, having room in her hold for 300 tons more, and yet was within 1 ft. 2 in. of the Plimsoll load line. After running as far as Tynemouth, the *Grafton's* head was turned, and against a heavy wind and sea a trial of speed took place, 9½ knots being obtained, highly satisfactory considering the weather. The machinery ran very smoothly, particulary the steam steering gear, in the working of which considerable interest was evinced. It is now five years since Mr. Simey commenced his experiments, and since then he has improved upon the machine on six occasions in matters of detail, the principle always remaining the same, and the gear fitted to the *Grafton* embodies the latest improvements. It is extremely simple in construction, and most compact, owing to the rack which controls the rudder chains being worked direct upon the top of the cylinder. The advantages claimed for the machine are:—It is silent and economical, is self-draining, and owing to the moving parts being few in number and large in surface, there is practically no wear and tear. There is no vibration to affect the compasses, and should a heavy sea strike the vessel, the piston yields sufficiently to prevent breakage of chains, afterwards returning automatically to its former position. Steel-wire rope can be used in the place of chains, the machine can be started at a moment's notice, and the amount of helm given can be controlled by the officers of the watch, thus preventing over-steering. It can either be worked from the flying bridge or the main bridge, and can be disconnected for hand steering in a few seconds. The working of the gear quite bore out the claims of the inventor, and all interested in the vessel expressed themselves thoroughly satisfied with it. After luncheon had been served, Capt. Morgan proposed the health of Messrs. Thompson, Clark, and Simey, expressing his thorough satisfaction, not only with the steamer and her fittings, but also at the kindly feeling which had characterised his business relations with them. During the past ten years he had come to Sunderland for vessels, and had always been satisfied with his purchases.—Mr. W. Clark, in response, also bore testimony to the good feeling existing, and remarked that for a cargo steamer the *Grafton* would fulfil all modern requirements. He trusted that another order would soon be in hand.—Mr. C. Thompson and Mr. Simey also responded, after which "Success to the *Grafton* and her managing owners" was drunk, on the proposition of Mr. Clark, followed by the toast of "The Ladies." The company then returned to the tug, the *Grafton*, under the command of Capt. Wake, proceeding on her voyage to London, where, after discharging, she will load a general cargo for Rangoon.

Bordeaux.—On December 7th, the trial trip took place of the *Bordeaux*; built for the Company Swedish Lloyds at Gothenburg, in the yard of the Motala Company at Lindholmen, near Gothenburg. Her principal dimensions are:—Length, 200 ft.; breadth moulded, 29 ft. 6 in.; depth of hold, 23 ft. 2 in.; with a hold capacity of 72,000 cubic feet. Bunkers and all, the carrying capacity will be about 1,000 tons on the 16 feet line. During the trip the engines of 110 nominal horse power worked very satisfactorly, giving the ship a speed of 10·15 knots, with a coal consumption of 15·75 cubic feet.

Nanna.—The trial trip of this steamer, which was launched a month ago from the yard at Lindholmen, near Gothenburg, to the order of Mr. John Giertsen and others, of Bergen, Norway, took place on December 20th. When going out, the ship had a full load of wood and 40 tons of coal on board; the draught of water being 11 ft. 3 in. The engines, of 50 nominal horse power, worked well throughout; the speed attained being a little more than 8 knots with a coal consumption of 9 cubic feet. *Nanna* is of the following dimensions:—Length, 159 ft.; Breadth moulded, 27 ft. 10 in.; depth of hold, 15 ft. 6 in.; is built to class at London Lloyd's with raised quarter-deck and bridge house. This ship will be under the command of Captain H. Schjoti, and is intended for Mediterranean and Baltic trade.

Tancarville (s.)—This steamer, which was built by Messrs. Campbell, Mackintosh, & Bowstead, to the order of Mr. Cicero Brown, of Havre, went on her trial trip on December the 8th. The *Tancarville* is of the following dimensions:—Length, 293 ft.; breadth, 37·75; depth, 27·5; and can carry 3,200 tons deadweight. She is brigantine-rigged with double topsails, and is furnished with four steam winches by Messrs. Clark, Chapman, and Gurney, of Gateshead; a patent windlass by Messrs. Emerson, Walker, and Co., of London; and a steam steering apparatus by Messrs. Higginson and Co., of Liverpool. The engines are by Messrs. Thomas Clark and Co., Elswick, and are of 250 nominal and 1,300 effective horse power. The trial trip was in every respect satisfactory, and a speed of twelve knots was attained. The engines and boilers were put on board at the hydraulic crane belonging to Sir W. G. Armstrong and Co., Elswick. She was thus completely finished and ready for sea before passing the bridges at Newcastle, and it is understood she is the largest ship that has yet passed through the Swing Bridge. The *Tancarville* is commanded by Captain Pontie, and proceeded to Havre on the completion of the trial trip. She is chartered for a mail service between Canada and Brazil.

Sury Wongse.—On December 15th, the steamer *Sury Wongse*, which has been built to the order of Messrs. A. Markwald & Co., by Messrs. Wigham Richardson & Co., took place, but on account of the fog, the speed could not be very accurately ascertained. In the estimation of the Pilot she was running fully 14 knots, but, at any rate, when going under easy steam she did over 12 knots. The steamer is estimated to carry 1,175 tons on 14 ft. draught, and will be one of the fastest steamers on the China coast, where she is to trade.

Iolani.—This screw steamer went down the Clyde on her official-trip on December 14th, and attained the speed of 11 knots with ordinary working. She left for London, having been chartered by Messrs. D. Currie & Co. to go to the Cape. She has been built to the highest class at Lloyd's by Messrs. Murdoch & Murray for Messrs. Raeburn & Verel, Glasgow. Her engines, of about 170-horse power nominal, have been supplied by Messrs. Kincaid, Donald & Co., Greenock. She carries about 2,300 deadweight, and is on the three deck rule, upper deck being iron.

Sevilla.—On December 16th the new screw steamer *Sevilla*, which has been built to the order of Messrs. Henry Lamont & Co, Glasgow, by Messrs. Henry Murray & Co., Port Glasgow, went down the Firth of Clyde on a trial run, when a speed of 11¼ knots was attained. The following are the dimensions of the *Sevilla*:—190 ft. by 27 ft. by 13 ft. 11 in; her engines, of 100 nominal horse power, have been supplied by Messrs. Hutson & Corbett, Kelvinhaugh Engine Works, Glasgow. She has been built to the highest class at Lloyd's, is fitted with about 140 tons of water ballast in double bottom, and has three steam winches, and all the latest improvements. She is intended for the fruit and ore trades.

Principia.—The screw steamer *Principia*, built for Messrs. Newton Bros., of Burton-on-Trent and Hull, by the Palmer Shipbuilding & Iron Company at Jarrow, made a successful trip to sea on December 17th. This vessel is 316 ft. 6 in. in length; 33 ft. breadth of beam; 28 ft. in depth; her deadweight carrying capacity is 3,800 tons. The engines are the Palmer Company's componnd-surface condensing engines of 300-horse power nominal, the diameter of the cylinder 38 in. and 70 in. respectively, and the piston stroke 48 in.

Chittagong. - The *Chittagong* (s), which has been built by Messrs. Raylton Dixon & Co., and whose launch we noticed some little time ago, left the yard of her builders on December 21st on her first voyage, direct from Middlesbrough for Rangoon, with a cargo of steel rails. Her dimensions are:—Length, 285 ft.; breadth, 36 ft. 3 in.; depth, 23 ft. 3 in.; and her carrying capacity about 2,900 tons, having engines of 180-horse power, made by Messrs. Blair & Co. She has water ballast throughout on cellular principle, iron main and upper deck, covered with teak, cabins in poop and aft, long close bridge, and topgallant forecastle, and being built principally for the Rangoon trade, is fitted with special arrangements for loading, ventilating, and discharging rice cargoes. She is commanded by Captain M'Kirdy, late of the British Indian Steam Navigation Company's service, who has superintended her construction, and is one of her principal owners. She is owned by Messrs. P. Henderson & Co., of Glasgow.

Reviews.

The Transactions of the Institution of Naval Architects of 1881.

The number of Papers devoted to the use of Steel in Shipbuilding and boiler making, and the various remarks thrown out in discussing its merits and demerits at the Twenty-second meeting of this Institution, clearly shows the rapid strides that are being made in the introduction of steel in place of iron both for ship and boiler work.

Mr. J. D'A. Samuda, in his Paper on "The *Almirante Brown* Argentine cased-corvette, and the effect of steel hulls and steel faced armour," gave some very interesting statistics as to the saving in weight of hull by the employment of steel, and the resisting power and weight of steel-faced armour as compared with iron armour. His discourse was illustrated by some useful diagrams on the walls of the hall of the Society of Arts, which would have added to the value of the volume if made into plates, and considerably relieved the monotony of wave lines, breaking strain diagrams of crank shafts and curves of resistance, &c., &c., with which these volumes are so fully illustrated year after year.

Mr. W. Parker's Paper "On the Pecularities of Behaviour of Steel Plates supplied for the boilers of the Imperial Russian Yacht *Livadia* is a most valuable contribution to the contents of this volume.

M. Marc Berrier Fontaine, "On the use of Mild Steel for shipbuilding in the dockyards of the French Navy," gives to the Institution of English Naval Architects a good idea that our French neighbours are still inclined to hold their own in matters appertaining to high-class shipbuilding, as they were nearly a century ago, when war vessels captured from the French were always preferred by our fighting captains as much handier than vessels of our own build. The three Papers above mentioned, drew forth a large amount of discussion which, together with the valuable data given by each writer, are worth the particular study of marine engineers in any way interested in the question of steel *versus* iron.

The Papers "On the Stability of certain Merchant ships," and "On the Rolling of Sailing ships," by W. H. White, Esq., Assistant Constructor at the Admiralty, &c., are of a high class, and fully equal to any of the numerous Papers read in the past by this well known theorist.

Mr. Froude, "On the Leading Phenomena of the Wave-making Resistance of ships," displays a desire to follow in the footsteps of his lamented father in this subject. The amount of labour and patience expended on such a Paper, cannot be estimated, but will any of our leading Naval designers ever reap any benefit from these tank experiments.

With the exception of Mr. Milton's Paper "On Crank Shafts," and Mr. W. Denny's Paper "On Local Education in Naval Architecture," the remainder do not merit any special notice, with the exception that they respectively treat on various subjects in a very satisfactory manner.

Taken as a whole, this volume will compare favourably with its predecessors, although it does not in any way surpass several former issues.

It will be noticed by those who peruse the opening proceedings, that this Institution has gained in the Right Hon. the Earl of Ravensworth, a most able President, to follow the Presidency of the late Lord Hampton. It will also be seen that, the Institution is in a most thriving condition, both in point of members and funds. With the abnormal increase of new life infused during the last few years into this formerly rather lethargic Institution, their removal into rooms more becoming the character of such a Society, and the growing interest displayed in its working it, evidently bids fair to flourish and gain the position that such an Institution deserves to hold in a country whose maritime power is her greatest bulwark.

Lectures on Naval Architecture and Marine Engineering. Published by William Collins, Sons, & Co., London and Glasgow.

These lectures are a compilation of those delivered at an exhibition of naval architecture and marine engineering in Glasgow during the winter of 1880-1. This proved a most successful exhibition, and the lectures delivered during its continuance seem to have formed a most interesting theoretical addition to the practical information collected in the exhibition. No consecutive order in arrangement or choice of subject was attempted by the committee as affecting the lectures, or in the form in which the lectures are printed. The lectures are nine in all, and are on a variety of subjects. The first deals with recent improvements in naval architecture. It is by Mr. Wm. Pearce, of Messrs. John Elder & Co., and is rather a sketchy review of construction from the *Great Eastern* on to the *Livadia*. It is followed by a very detailed and exhaustive paper on the laying and repairing of submarine telegraph cables by Andrew Jamieson, C.E. The variety of routes is clearly shown in a map, the construction of the cables shown in detail; the method of laying, the operation of testing for resistance, and the process of splicing and picking up, are all clearly set forth and explained. An interesting lecture on the equivalence of heat to effect work, by Robert Mansell, Esq., of Messrs. Aitken and Mansel, and another on Lighthouses by Sir Wm. Thompson, follow.

Yachting and yacht-building is described by G. L. Watson, Esq., and the rise and progress of steam navigation, with a most interesting plate, showing the comparative sizes of leading vessels from the *Comet*, 1812, to the *City of Rome*, 1881, is set forth by W. J. Millar, Esq., C.E., in a most readable manner.

"The Resistance of Speed of Ships," by Frank P. Purvis, Esq., "The River Clyde and Harbour of Glasgow," by James Deas, Esq., and a Paper on "Steel," by Jas. Riley, of the Steel Company of Scotland, Limited, complete the book. The book thus contains in a concise form general information by the leading men of the day, on a large variety of topics all of interest to marine engineers. It is well and clearly printed, and contains many illustrations.

Naval Hygiene.—By J. D. Macdonald, M.D., F.R.S., Inspector General R N., Professor of Naval Hygiene, Army Medical School, Netley.

This work, emanating from such an authority on the special subject it deals with, cannot fail in commanding the attention of naval medical officers, captains, masters, shipowners, and all in any way interested and entrusted with the general health and well fare of British or foreign seamen. It contains a fund of amusing and instructive reading, entitling it to rank as a useful addition to any library.

In the 1st Division the Shipbuilding Retrospect, although very brief, is a most interesting description of maritime structures from the time of the Ancient Britons. The sections, detailing "Designing and then Drawing," "Construction of Wooden Ships," and the "Construction of Iron Ships," are interesting in many of their details, and are illustrated and explained in a manner which reflects great credit on the author, when the difficulty of this special subject is considered. The plans and sketches shown and explained are, in most instances, correct and instructive, although now, in nearly every instance, entirely obsolete methods of design and construction. The descriptions of the laps and butts of plates and other practical details connected with the construction of iron ships, and the remarks concerning the method of determining trim, &c., although evidently studied by the author with great care, should not attract any attention.

Chapter II., "The Ventilation of Ships." In this chapter the important subject of ventilation, with the results of many valuable experiments, is well illustrated and described. Here the author fully shows his knowledge and experience in this highly important requirement, and the whole chapter, which is by far the longest in this work, deserves the most careful reading and consideration. The remarks and data given upon atmospheric air, its physical constitution and properties, the physics of the atmosphere, and leading principles of ventilation are highly interesting to general readers, and particularly useful to all engaged in maritime pursuits. The application of special bowls and shafts, including descriptions and illustrations of methods devised and recommended by the author and other authorities on the sanitary ventilation of ships, should demand notice, and the twenty-nine analyses of the air given in Table 1, made in the three principal sleeping compartments of H.M.S. *Devastation* during her trial trips in 1873, carbonic acid being taken as the index of impurity, together with the favourable comparisons made from the results obtained as against observations made in other vessels, deserves to be fully understood and appreciated by medical naval officers and others in command, as well as by the naval architect and designer.

In Chapter III. the author again displays his special ability concerning the nature and best means of keeping up a supply of good water. In his own words, "the origin and spread of a certain class of diseases, due to the contamination of the drinking water, was long known to the Government of India, until it was decided in 1866 that competent analysts should visit the various military stations, and draw up accurate reports as to the condition of the water in use. This duty at first devolved upon civil officers, but of late years it has been conducted by military surgeons instructed in the laboratory of the Netley Medical School." Considering the great importance always to be attached to the question of the water supply amongst our troops abroad, our seamen on board ship, or the inhabitants of our numerous towns and villages at home, a perusal of the suggestions and the results of experiments, given by one who occupies a position at the head of the staff specially appointed to analyse and determine the nature and hygienic qualities and uses of water, should be most valuable and receive general attention. And the suggestions concerning the condensing, stowage, and filration of water on board ship should be studied by all naval officers, as also the instructions given in regard to ordinary and special test solutions.

Chapter IV. applies solely to the necessity of personal cleanliness, and the prevention of humidity on board ship as great beneficial factors to the health of all on board. Here the benefits of a perfect system of ventilation are peculiarly noticeable, and the remarks on the too frequent wetting of decks, and causing seamen to be two or three hours per day partly immersed in water, would convince the reader that many improvements may be made in this direction, and the health of the seaman thereby secured.

In concluding Division 1, the historical retrospect and present scale of diet, the source and mode of preparation of some of the more important articles issued to seamen, the adaptation of diet to climate, &c., and the remarks on exercise and recreation for hygienic purposes, are all valuable and of the most useful nature.

Division 2, Prophylactic Hygiene. This division should recommend itself to medical men in particular, the issue of anti-scorbutics when necessary, the issue of quinine in malarious districts, and the vaccination or re-vaccination of seamen as a prophylactic against small-pox, together with the steps taken and the orders issued by our Admiralty on each respective head, and under various circumstances, are here well explained in Sections A, B, C, and D, and Sections E to H set forth most important instructions and regulations concerning hospital ships and their arrangements as to water supply, ventilation, measurement, and allowance of cubic space, and general sanitary provisions.

Division 3, Remedial or Corrective Hygiene. This calls attention to all internal sources of disease that may exist on board ship, or such as may have been introduced from without, demanding correcting or removal. Sections A and B deal with the treatment of bilges and bilge effluvia, water closets, &c., and the uses of antiseptics, deodorants, and disinfectants, together with directions as to their composition and abstract of various experiments. Section C, in dealing with the treatment of infected ships, brings the first chapter of this division to a most useful termination.

Chapter II. of this division, if full of advice concerning the segregation of the sick on the first appearance of infectious disease, the disinfection of the bedding, clothing and effects of the sick, and modes of fumigation, with accounts of the results of particular cases.

Division 4, or appendix, is a general dissertation on the daily routine of maritime life, setting forth, amongst other duties, the special duties and responsibilities of medical officers, and giving some good forms of ambulance lifts for ships of war, the appendix of medical instructions and enactments consisting of a large list of selections from the Queen's regulations and Admiralty instructions bearing on naval hygiene (1879), carefully selected for the purpose of assistance to medical men, ships' captains and masters, army officers, &c., are most valuable for reference and information. The contents of this volume are most clearly divided and subdivided in four leading divisions and a series of chapters at the commencement, and at the finish an alphabetical index to all leading technicalities and matter will be of the greatest assistance to the reader.

Taking this work as a whole, it should command and recommend itself to the consideration and notice of Army and Navy officials, particularly the medical branches of each. It should be studied by the naval designer and constructor, and would be found to contain a large and varied amount of most interesting reading and information, rendering the book valuable to all classes of engineers and architects.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

ANTI-CORROSIVE AND ANTI-FOULING COMPOSITION.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—Having noticed from the recent editions of your valuable Journal, that you are taking considerable interest in Anti-fouling Compositions, I trust you will give room to a few more remarks on this subject.

You refer in your last edition to the necessity, that such compositions should possess *exfoliating qualities*.

When Anti-fouling Compositions were first brought into the market, their necessity was most felt by iron sailing ships, which, when coated with ordinary paint, sometimes turned up from a long voyage with their bottom in a most shocking state, and hardly able to move through the water. Most of these ships got their foul bottoms when becalmed, and the "parasite" in that case was the common barnacle. Now, it was found when an *exfoliating* composition was applied that, although there was nothing in the paint to *prevent* the barnacles from adhering while the ship lay becalmed, still as soon as she got under way with a stiff breeze the barnacles lost their hold, and the ship, if not too long in the water came home clean. Other compositions made on the *enamel* principle and *highly poisoned* were tried for sailing ships, but although in some instances apparently successful, they gave a poor average result, *for although they might for a time prevent the adhesion of barnacles*, still when the barnacles had once got a firm hold, they would stick to the ships "like grim death."

If, however, the proverb that "the proof of the pudding is in the eating of it," is correct, there is no doubt that these compositions have proved an entire success on *steamers*, for nearly every steamer now docking is painted with one of the many quick drying, enamel surface, and non-exfoliating compositions now in use.

These compositions derive their anti-fouling properties from *strong poisons*, of which, oxide and chloride of mercury are the most effective. Steamers are not becalmed, but get their parasites in part only. The parasites growing in the different *ports* are principally *shells* and marine grass or polypes, not *barnacles*, which only adhere on the high seas. The most dangerous are the shells, which, if they once adhere to any paint whatever it may be, get so firm a hold that they are only to be got off with chisels. I have seen a steamer, only four months before painted with tallow (a most approved exfoliator), covered with shells which had penetrated through tallow and paint and stuck hard and fast on the bare iron, although all around the tallow and red lead was in a perfect state of preservation. A strong mercurial paint, however, for a time at least, is a sure preventive of the adhesion of these shells and grass, as has been proven by the success of the different mercurial enamel paints now in use. Let me here remark that the mercurial coating must not be brought in contact with the iron, and that in all cases a coat of priming, which is usually supplied with these paints, must be used.

When so coated they prove a perfect preservative, *particularly as no exfoliation takes place*, the composition keeping its original hard surface. These compositions, usually mixed with spirits of wine or benzoline, have furthermore the advantage of quick drying, and, in consequence of their smooth enamel-like surface, offer a minimum of surface friction, thereby increasing the speed of the vessel. May I be allowed, in conclusion, to mention one of these compositions: the "International Anti-fouling Paint, which is being manufactured by Messrs. M. Holzapfel & Co., Newcastle-on-Tyne, and which possesses all the ingredients necessary to ensure its speedy adoption by all steamship owners, which furthermore on account of its cheapness can compete in price with ordinary paint.

Apologizing for so far trespassing upon your valuable space.

I am, Dear Sir,
A North-Country Ship-Owner.

December 10th, 1881.

PRESERVATION OF FOOD.

To the Editor of The Marine Engineer.

Sir,—How most efficiently to apply our existing food in the animal and vegetable forms so as always to have a surplus in hand in readiness for emergencies; to enable the speculator to store up food as well as other commodities without risk of destruction. In all articles of periodical produce, and especially in food, it will be found that fluctuations in price are greatest in proportion to the difficulty of preservation. Three conditions are essential to the process of putrefaction, viz.: heat, moisture, and still air. Without air every thing is locked up and remains in *statu quo*. In direct opposition to these principles are the granaries of Great Britain and of other countries constructed. Here the weevil is naturalized in every crevice, like cockroaches in West Indian sugar-ships, together with the existence of rats and mice as well as of germination. In the exclusion of air is to be found the remedy. The practicalization of this is neither difficult or costly; close granaries should be constructed either under or above ground of cast-iron like gasometer tanks or of brick and cement. They must be air-tight and, consequently, water-tight. A man-hole at the top is all the opening required with an air-tight cover. An air-pump is adjusted for exhausting the air, and an archimedean screw-pump for discharging the grain makes the whole apparatus complete. If we provide for wet grain a water-pump may be added, and what is good on land is also good at sea. Similar reservoirs or magazines should be constructed on a smaller scale for butchers or other provision dealers. *And so with the fish* brought to Billingsgate and other markets; thus preventing the necessity of waste, or of selling at ruinously low prices!

I am, Sir, your obedient servant,
Augustus J. Harvey, F.R.G.S.

6, Cromwell Terrace, Southtown,
Great Yarmouth, 1881.

MARINE GOVERNORS.

To the Editor of The Marine Engineer.

Sir,—Among the open questions of the day, that relating to the available room and buoyancy for cargo in screw-steamers is certainly not the least important, and correct suggestions to that end, can find no better place than in a paper like The Marine Engineer.

Taking a retrospective review of the history of screw-steamers, it will be remembered that their hulls were first constructed in accordance with the experience gained with paddlewheel steamers; but owing to the very different position and action of the screw, with the resultant blows and shocks, the vessels proved too frail, and leaks arising therefrom were of very frequent occurrence, not to speak of the many broken shafts.

Since that time, always more additional material and strength had to be given to the ships, until at present every thing possible is done in this direction, almost without regard to expense, but the consequent surplus in weight calls now for means of economy in favour of paying cargo. To this purpose steel is already largely used instead of iron; it brings about a saving in weight, to be sure, but in regard to first cost, almost the contrary.

There is, however, another and indirect way to secure economy, not only in weight, but in other directions at the same time.

Suppose the screw did work as smoothly in a rough sea as in calm weather, the former ships would have been strong enough; not being thus subjected to such fearful momentary strains, as is actually the case, when the screw is plunging again into the water while the engines are racing; consequently, those excessive reinforcements now obligatory may be in the greater part dispensed with, in so regulating the rotation of the screw, that the way described by it never exceeds the velocity of the ship plus the slip, producing absolute smoothness in the action of the screw, and saving hundreds of tons and thousands of £s. in the construction of large ships.

This is the duty of a governor, as is well known, and endeavours to produce such are indeed not missing, but the complete failure of them all for marine engines lies in the employment of an improper and impotent medium; with centrifugal force such poor results only are obtainable, that even the regulation by hand is deemed preferable: which is as unmechanical as possible, and not much better than effecting the distribution of the steam by hand.

Anything that can be performed automatically is always done with far more precision and accuracy, than the highest degree of intelligence and vigilance is capable to accomplish by hand, and so it is with the governing of steam-engines, provided the correct means are employed. The variations in their speed being dependent of the changes in the load, these latter constitute the only correct automatic agency. *The ideal governor for steam-engines is nothing else than a machine weighing accurately the resistances, and applying this measure synchronously to the direct determination of the supply of motive force.*

For its realization elasticity must be resorted to, which is by no means objectionable in any way, as for itself it is proper to prevent the destructive influence of shocks, and also in a great degree such breakdowns as are occasioned by misplaced rigidity like that between engines and screw; as an example, may be taken the effect of railway-wagons one on another if deprived of buffer-springs: every thing is smashed with a moderate concussion only.

Though the above arguments are irrefutable, said system of governors will be opposed by all people beset of prejudgment, old routine, and egotism, as it overthrows a lot of inveterate habits and accepted rules; yet it must and will break its way sooner or later, there being no small improvement in safety, and too great a saving to shipowners and insurance companies to be derived from it.

It must be admitted though, that said system is not new, but was thought fit for small powers only, and had not been brought into a really practical shape as yet, in fact, it is only by the particular position and distribution of springs, as adapted on the dynamometrical governor illustrated in last November number of The Marine Engineer, that the proper means are given at hand, to deal with thousands of horse-powers at once; combining extraordinary compactness, sensitiveness, and handiness, together with utmost solidity.

Said mechanism as a buffer-coupling, dynamometer, and governor at the same time, and with its diverse measuring and recording instruments, is sure to give unexpected satisfaction, from the largest down to the smallest scale, in spite of all imaginable criticism.

E. A. Bourry, C.E.

St. Gall, Switzerland, Dec. 17th, 1881.

To the Editor of The Marine Engineer.

Sir,—Mr. F. C. Marshall in his Paper read at Newcastle before the Mechanical Engineers says: "Mr. Perkins has shown us that boilers can be worked AT SEA with pure water, themselves making up their own waste, and can be kept absolutely clean and free from injurious deposit." Would any of your subscribers kindly explain Mr. Perkins' system, in particular, how boilers are to make up their own waste ?

I remain, Sir, your obedient Servant,
T. C. WARKMAN,
Engineer with Messrs. I. & V. Florio.
Palermo, December 8th, 1881.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 20th November, to 19th December, 1881.

5100 J. Patten. Rotary engines.
5103 E. Winshurst. Distilling water.
5110 R. Hallewell. Generating motive power.
5137 C. W. Cooper (communicated by Clark). Pumping liquids.
5153 J. Thompson and G. Cooper. Construction of slipways.
5156 A. Brossard. Rotary engines.
5169 W. W. Girdwood. Regulating speed of engines.
5172 R. Henneberg and A. Herzberg (communicated by C. Pieper). Water-closets.
5173 J. Ritz and A. Nebele (communicated by W. Barlow). Rotary engines.
5175 D. Young. Speed indicator and alarm.
5176 J. Harrison. Steam boilers.
5182 W. Mather. Boilers.
5217 W. Clarke. Cranes.
5228 J. Thomas. Breakwaters.
5236 J. N. Holliday. Steering apparatus.
5237 L. A. W. Desruelles and C. F. Carlier (communicated by H. E. Newton). Motive power.
5245 J. A. Andree (communicated by C. D. Abel). Propellers.
5256 J. Davies. Lubricators.
5280 H. J. Harman. Fusible plugs.
5289 G. H. Babcock and others (communicated by W. Wise). Steam generators.
5293 J. Schreiber and F. H. Moldenhauer (communicated by E. A. Brydges). Steam boilers.
5294 E. Kaulbach. Furnaces.
5298 W. D. Preestman. Cranes.
5300 H. Fauler. Pumps.
5308 L. McIntyre. Steam boilers.
5311 T. H. Ward. Pulley blocks.
5326 H. Sharp. Steam boilers.
5334 H. B. McIntosh. Main sheets.
5354 P. Cardew. Speed indicator.
5374 W. Lowrie and J. A. Rowe. Lowering blocks.
5379 J. C. Baker. Ventilating ships.
5380 E. J. Hill and J. L. Clark. Detaching boats.
5387 H. B. Young. Steam engines.
5404 S. Schuman. Jacketing.
5417 W. H. Marks. Steamers.
5434 G. G. De Luna Byron. Life Preserving Mattresses.
5441 D. S. Chapin (communicated by H. J. Haddan). Pumps.
5442 E. C. Martin. Rowlocks.
5455 J. Taylor. Screw Propellers.
5492 S. Bolton. Range finding.
5498 W. Lockwood. Spring packing.
5511 D. B. Hutton. Ascertaining propeller pitch.
5512 R. H. Hughes. Laying course on chart.
5518 P. A. McEvoy. Torpedo operations, searching for submerged bodies, &c.
5529 R. Hodgson. Wreck raising.
5530 E. Hayes. Stern posts of screw-steamers.

BOARD OF TRADE EXAMINATIONS.

November 26th, 1881.

Andrews, Wm.	1 C	London.
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Chisholm, Hgh.	2 C	London.
Colam, Wm. N.	1 C	London.
Duckham, Hry.	2 C	London.
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December 3rd, 1881.

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Wyles, Dvd. D.	2 C	London.
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December 10th, 1881.

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December 17th, 1881.

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Robertson, Wm.	1 C	do.
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Reynard, James	1 C	N Shlds.
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Stewart, George	2 C	do.
Stephen, Thos.	2 C	N Shlds.
Tunstall, Ths. H.	2 C	Plymouth
Whyte, William	2 C	Glasgow.

December 24th, 1881.

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Barnsley, Mich.	2 C	do.
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Dixon, George	1 C	do.
Deuchar, Alex. J. W.	1 C	Lvrpool.
Eglinton, Robt.	2 C	do.
Gray, Andrew	1 C	N Shlds.
Harvey, Richd.	2 C	Lvrpool.
Halliday, Thos.	2 C	do.
Hall, Stephen E.	1 C	do.
Jones, David E.	1 C	London.
Jeanes, Thos. G.	2 C	N Shlds.
Lawson, Roger	2 C	do.
Lewis, John T.	2 C	Lvrpool.
McKay, Jas. A.	2 C	do.
McVie, John ...	2 C	do.
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Pippet, Wm. ...	2 C	do.
Pellew, Sydney	1 C	do.
Pugh, Morgan	1 C	do.
Ross, Donald ...	2 C	Lvrpool.
Wylie, William	1 C	N Shlds.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any M.S.S.

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SUBSCRIPTIONS.

The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, FEBRUARY 1, 1882.

EDITORIAL NOTES.

A SAD fate seems to pursue our ironclad Navy; scientific advance but seems to increase our risks; what with incautious attendants being struck suddenly dead by electric currents accidentally diverted through their bodies, and sailors being blown to pieces by the explosion of xerotine siccative, the lives of those brought in contact with such new scientific experiments are certainly far from "happy ones" or free from risk. The details of the late fatal explosion on board H.M.S. *Triumph*, from the violent ignition of xerotine siccative are now probably well known to our readers. A leakage of the "Patent Driers" into the space between the two shells of the hull was ignited by a seaman who had no reason to imagine any explosive or dangerous substance could be there present. This occurrence has caused such strong opinion that the loss of the *Doterel* may be attributable to the same cause, that the whole subject of the *Doterel* enquiry is to be re-opened. It seems that some of the survivors are prepared to testify that only a quarter of an hour before the explosion took place, a considerable leakage of the "Patent Driers" had been discovered in the store-room immediately adjacent to the fore magazine, and further, that a man had been sent in with a light a few minutes before the explosion, probably to clear up the mess. Here is the primary explosion that has so puzzled technical minds acquainted with the circumstances satisfactorily explained. The finding of the Court, that the primary explosion arose from the ignition of gas in the coal bunkers seemed far from possible when the excellent means of ventilation is taken into account. However, the primary explosion before that of the magazine was so well established, that some such finding was a necessity, and no other known explosive substance that might have been present was then thought of. We are glad to hear that this scientific "Driers" is being got rid of as rapidly as possible over the side.

M. Lessep's Panama Canal undertaking makes but slow progress as yet. The labourers must all become acclimatized by fever as a matter of course, no doubt to their great risk at the time, and according to all reports, to their complete disorganization afterwards. This must be a serious drawback, to say the least, to the progress of the work. There is, however, a still more serious opposition threatening to the work, even when completed. The political views of the United States upon the necessity of any such canal being solely under American protection is likely to take a practical form in the organization of an opposition canal by Nicaragua. A company is now being formed in the States to carry this out, such well-known names as those of General Grant, Mr. Jewett, Mr. Ten Broeck, and Mr. Chymer, being amongst its numbers. As it is proposed that the United States shall guarantee a minimum of Three per cent. for twenty years, there will be no difficulty in such case of finding the capital. As it is an open question yet, whether the traffic would pay a suitable interest upon the cost of one canal, the construction of a rival water-way will certainly result in the non-financial success of both.

ALTHOUGH there is much and loudly expressed feeling amongst outsiders that the "Plimsoll Load Mark" is not sufficiently arbitrary against ship-owners, such loudly expressed opinions chiefly serve to show the ignorance upon the difficulties surrounding the subject of those who attempt to deal with the matter so arbitrarily. It would be either grossly unfair to the ship-owners to fix an invariable load-line to any ship for all seasons and circumstances, or else perfectly useless for purposes of protection according to whether a high or low extreme were arbitrarily fixed upon. The load-line may be well and fairly altered for every voyage. The line for August and the line for October may suitably be quite different. In the same manner, the conditions of load-line for a light or for a heavy cargo, for one that is sinkable, and for one that is unsinkable, may well vary. The present chief, and in fact very great value of Plimsoll's mark, is to register the depth to which any owner purposes to load a vessel under given circumstances. Should anything happen, the conditions stand recorded, and the responsibility may be fixed. The protection against over-loading is obvious; all arbitrary official interference must always press unfairly in many circumstances, and is entirely contrary to our system of self-government and individual responsibility. Such lines of legislation are, therefore, to be avoided if possible, and we think there is but little now to be laid to the charge of over-loading or unseaworthiness; collisions and short-handedness, with inefficient pumping apparatus, are now, to our mind, the chief defects in our mercantile Marine.

THE subject of dock accommodation, and the effect of dock accommodation, and rates on the trade of a port, is a most important one to any town claiming a position as a port. The new docks at Milford Haven promise to create a revolution in the carrying trade between England and America. The saving in distance to American trading vessels would be 174 miles as compared with Liverpool, but more important still, the dangers of St. George's Channel would be avoided. This latter danger is by no means a slight one, as it will be found from the investigation of statistics that a very large proportion of the losses in American traders have occurred in that Channel, owing to the dangers of a lee coast in the prevalent south-westerly gales. A company of powerful members has been formed already to run a new line of powerful steamers from this port. Such competition should, however, have one good effect for ship owners and merchants—it should tend to lower dock rates.

IT seems, however, that the directors of the London, East and West India Docks have not learnt the necessary consequence of competition—viz., a lowering of rates. Already London is most seriously overweighted with rates as a shipping port compared with her rivals, such as Liverpool, and with very obvious results—viz., a large divergence of shipping to the cheaper ports. Perhaps it may be startling information to some that Liverpool, with a smaller dock area than that of London, works 7½ million tons of shipping per annum, whilst London only deals with about 4½ millions of tons. And yet the London dock directors can only see their way to increasing their capital outlay, and correspondingly increasing their rates by mutual agreement. Howeve wordly wise an agreement may be amongst themselves for dealing with what shipping is obliged to come to London, the ultimate effect upon the shipping trade of London as a port cannot be otherwise than most disastrous. If the vast sums expended on the London docks and works are now unsuitable for the traffic, and fresh works must be put in hand in a more advantageou situation, surely the directors know the first principle of business to "cut a loss," whilst it is bearable, rather than throw good money after bad. The construction of new docks at Tilbury will certainly do much for London as a port and for its shipping trade, but a prohibitive rate put on to bolster up a former speculation, now found to be antiquated, and somewhat of a commercial failure, will only serve to damn the whole.

SOME time ago we drew attention to an experiment that was to be tried with oil used as means of reducing the breaking of waves into harbours and anchorages. The project may have seemed somewhat visionary to sceptical minds, but the results seem to give practical importance to the system. The experiment has been carried out at Peterhead, the supply of oil being distributed by pumping through perforated pipes throughout the harbour. The result of the trial was considered highly satisfactory, waves of considerable height were rolling in and breaking as soon as they entered the narrow space between the headlands of the harbour's mouth. After pumping for half an hour the whole expanse of the harbour was covered with oil, and the waves, on nearing the harbour, became mere gentle undulations, whilst they ceased to break at all. Perhaps, in a few years to come, oil may become an acknowledged means for aid in stilling the waves in case of shipwreck and violent seas, and be discharged from the shore or from the vessel itself.

NOTICE.—Owing to great pressure on our space, we are obliged to hold over the article on "Ocean Steamship Machinery" until our next issue.—ED. M.E.

THE NEW SCREW STEAMER "MERTON HALL."

THE screw steamer *Merton Hall* (see double-page illustration in this number), which was launched on December 22nd, is a steel steamer of 4,178 tons gross register, and is the largest vessel yet built in Dundee or the east of Scotland. Her extreme length is 411 feet, or 400 feet between perpendiculars; extreme breadth, 42 feet 3 inches; depth of hold, 29 feet 6 inches. The *Merton Hall* has been built and engined by Messrs. Gourlay Brothers & Co., to the order of Messrs. Alexander & Radcliffe, of Liverpool, for their Hall Line of steamers, which run between Liverpool and Bombay. The Hall Liners do not carry a large number of passengers, but very comfortable quarters are provided for twenty-four first-class passengers in a house on deck; and as the *Merton Hall* will have a good rate of speed, her cabins will, no doubt, be well filled—as indeed those of this line generally are. The rigging plan shows that the *Merton Hall* will have four masts—two square-rigged, and two with fore and aft canvas. The fore part of the vessel will be protected by a forecastle of turtleback shape. The engine and boiler spaces, which are of vital importance, are entirely covered, and there is a hood aft to protect the wheel and prevent water being shipped over the stern. The bulwarks are partly close and partly open; they are close where the sea is most likely to break on board, and open where it can best get clear, so that no great quantity of water can ever remain on deck. From the longitudinal section it will be seen that the vessel has three decks; these are of steel, and will give great longitudinal and transverse strength. The cabin is placed nearly amidships, and forward of the engines and boilers, so that the passengers will be free from the disagreeable accompaniments of moving machinery. The officers' berths are placed amidships alongside the engines and boilers, and are of the most comfortable character. The engines which are to be fitted on board the *Merton Hall* are to be high and low pressure and surface-condensing, of four hundred and sixty nominal, or two thousand five hundred effective horse-power. The cylinders are respectively forty-five and eighty-four inches diameter; and the length of stroke five feet. The pressure of steam is to be 80 lbs. per square inch, and will be supplied by three double-ended boilers having fourteen corrugated steel furnaces. The *Merton Hall* will have the highest class at Lloyd's, and everything will be done to fit her for the service intended. Besides the large engines for driving the vessel, there will be eight pairs of double engines and two single ones. These will be employed in steering the vessel, lifting the anchors and cargo, and pumping water. The steering engine will be placed far aft, so that passengers may not be disturbed by it.

NOTES RELATING TO THE PROPER METHOD OF EXPANSION OF STEAM AND REGULATION OF THE ENGINE.

By PROF. R. H. THURSTON.

Read before the American Society of Mechanical Engineers, Altoona Meeting, August, 1881.

IT has long been well known, to every engineer experienced in the construction and management of the steam-engine, that, when working under known conditions and at a given pressure of steam, there is a certain ratio of expansion which gives highest efficiency, *i.e.*, least expenditure of fuel in proportion to work done. It has also been long known that the most economical ratio of expansion, all things considered, when studied from the commercial standpoint, is to be determined not simply by studying those conditions which affect the efficiency of the engine, but by consideration of all the elements of cost of steam power, including first cost, interest on capital expended, wear and tear, and running expenses for fuel supply and management.

In the design of an engine it thus becomes necessary, if the designer would consult the best interests of the purchaser of the engine, first to determine, as best he can, what is likely to be the cost of each series of engines of the style proposed and of graded sizes; next must be determined the cost of power in weight of steam used in each of these engines at various pressures and ratios of expansion; finally, by comparison, he must select that engine which, at the least ratio of expansion, all things considered, will give the required power.

When the steam pressure and the cost of power in steam consumption are known, it becomes possible to determine the best point of cut-off. But no engineer has yet been able to say with certainty what, in any given case, will be the ratio of expansion giving highest efficiency, or, what, at any given rate, will be the probable expenditure of steam or fuel. The writer has endeavoured, in an earlier paper,* to show what are the causes of this uncertainty, what determines the most efficient adjustment of expansion, and what, on the whole, have, in his judgment, proved to be the ratios of expansion giving maximum efficiency, and, finally, what efficiency may probably be anticipated in cost of steam and of fuel in good engines, adjusted for maximum efficiency.

When these points are settled, the engineer may, by a proper use of the factors, ascertained as above indicated, determine what is the best ratio of expansion to adopt, or rather what is the best size of engine for the case in hand, and what the best type of valve gear and regulating mechanism. The size and kind of engines is therefore determinable from a knowledge of conditions, which are partly physical and incidental to construction, and partly commercial.

The solution of this second and broader problem may be effected either by a tentative process of trial and repeated estimation, or by an approximate, and for some cases—*e.g.*. where cylinder condensation is reduced to a minimum, as in efficiently jacketed or in fast-moving engines, or at low rates of expansion—nearly exact method, first indicated, so far as the writer is aware, by Professor Rankine,† who applies to the case one of those beautiful graphical constructions in the devising of which he was so ingenious and successful.

This method has been studied and has been applied to representative examples in recent practice in steam engineering by Messrs. Wolff & Denton,‡ who have shown that the commercially profitable grades of expansion are ordinarily restricted to a very narrow range, and always somewhat less than the ratio for maximum efficiency.

Having, then, fixed upon the size of engine and ratio of expansion, it is evident that this ratio of expansion should generally be kept invariable, so long as the steam pressure remains unchanged.

The usual changeable condition with a given engine is the demand for power, and, to meet this variation, it becomes necessary to adopt some method of regulation. The simplest forms of regulating apparatus usually consist of a "fly-ball" governor set engines is that adopted by Corliss—the attachment of the governor to the expansion gear in such a manner as to cause a variation of the ratio of expansion, adjusting the point of cut-off to the demand for power. This latter is the most sensitive regulating mechanism yet devised, and, where the variation is small, is very effective even at low speeds. The writer has counted the revolutions of a Corliss engine making about sixty revolutions per minute, with steam at 90 lbs. by gauge (7 atmospheres), and found a variation of but two revolutions per minute when the whole load was thrown off or on, the minimum being about 35 horse-power (driving shafting) and the maximum about 150.

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* "On the Ratio of Expansion at Maximum Efficiency," Trans. Am. Soc. Mech. Engrs., 1881; Journal Frank. Inst., May, 1881.

† Phil. Magazine; Trans. R. S. E.; Theory and Practice of Shipbuilding; Miscellaneous Papers.

‡ Trans. Am. Soc. Mech. Engr's., 1881; The American Engineer, 1881.

Since, however, the proper ratio of expansion for the engine when once installed is determined mainly by the steam pressure, and since any variation from that point is usually productive of reduction of efficiency, it would seem that the ratio should be fixed at the best proportion for the steam pressure adopted and never changed. This being the case, the question arises, how shall regulation be effected? The adjustment of a throttle-valve by the governor is inadmissible, as it involves variation of the steam pressure in the steam chest, and consequently reduced efficiency; the steam and expansion lines must be permanently fixed for all loads.

It becomes at once evident that any allowable system of regulation must now affect the back pressure or the cushion line. To throttle the exhaust by the action of the governor would undoubtedly give a means of regulation, but a costly one; since any increase of back pressure during the exhaust would involve serious increase in the amount of rejected heat and of waste of power.

It then becomes evident that the only admissible plan is the variation of the net power of the engine by an alteration of the compression line. This is done where one very well known and generally used valve gear is adopted—the Stephenson Link Motion. When the link is down the ratio of expansion is determined by the lap and lead, and is usually not higher than $\frac{1}{2}$; as the link is raised this ratio is increased, and with this change of the steam line occurs a simultaneous alteration of the point of release and of closure of the exhaust passages, resulting in increased compression. This double effect gives the indicator diagram a peculiar modification of form, familiar to engineers who have taken cards from the locomotive or the usual type of marine engine. The smoothness of working of such engines, when running with high steam and a raised link, has probably been observed by all experienced engineers, and it may not have escaped notice that, under such conditions, the expenditure of steam is often so low as to indicate some source of economy other than simple change in the ratio of expansion.

The writer, at least, when in charge of naval steam machinery during the war of 1861-5, was led to suspect a gain from this distribution of steam, which could only be attributed to what was considered excessive compression.

His attention has recently been called to this matter again by the interesting results of a series of experiments made upon a large engine fitted with variable expansion gear. The valve motion is so arranged as to permit adjustment of compression without change of either steam, expansion, or exhaust lines. The results will be reported in a later paper. It is only necessary here to state that a decided gain is found to follow the adjustment of the compression to a far higher ratio than is indicated as best by the simple geometrical conditions usually studied and generally taken as those determining the proper ratio of compression. This beneficial effect of a high ratio of compression has been attributed by the writer to the action of the compressed fluid in heating the passages and the cylinder head and piston, thus checking to a very great extent that initial cylinder condensation which is the greatest source of avoidable waste in nearly all engines.

It may be asserted that the best compression, where no such transfer of heat occurs, is not far from that which makes the ratios of expansion and compression equal, and the engineer will usually set the exhaust valve to close at the point corresponding to maximum expansion. For the reasons just given, however, and as shown by direct experiment, maximum efficiency is obtained with higher ratios of compression, and what would have been considered excessive cushioning gives less loss than equal variation from the point of cut-off giving maximum efficiency. As compression is increased, the area of the indicator diagram decreases and the work developed in the engine becomes less.

It would seem, then, that we have here an admissible method of regulation, and one which should be, on the whole, that best fitted to give high efficiency, since any excess of work of compression results simply in the transfer of heat back to the steam side. The steam engine should, therefore, be worked with a fixed cut-off,* so attaching the governor as to determine the point of closing of the exhaust valve—in other words, making the "cut-off" operate on the exhaust side, the ratio of compression being determined by the governor—instead of attaching the cut-off mechanism to the steam valves. Properly constructed relief valves will prevent all danger from the influx of water with the steam, an accident which, however, should never occur where provision is made for securing dry steam. With exhaust ports beneath the cylinder, drainage is rarely imperfect.

In slowly moving pumping engines it has sometimes been found beneficial to extend compression until boiler pressure is exceeded, and the writer has indicator diagrams taken from such engines in which the compression line crosses the steam line before the end of the return stroke has been reached. He has, as probably has every engineer who has been accustomed to handle locomotive or marine engines, often set the link motion so as to give such high ratios of expansion and compression as to reduce the card to a comparatively narrow band, without perceiving the slightest evidence of objectionable loss of smoothness of working and with decidedly improved efficiency. It seems to the writer doubtful whether, in practice, objectionable or "excessive" compression ever occurs in such cases, and the advantages of this method of regulation and of securing a lessened variability in the ratio of expansion would appear to be decided and to be obtainable without meeting with serious difficulties.

The plan is probably not entirely a novel one and may have suggested itself to many engineers independently; but no attempt has previously, so far as the writer is aware, been made to determine its advantages in actual work. The writer indicated this as the proper method of adjusting expansion some years ago,† and has since had it presented to him by other engineers with whom the thought was also original.

Where the plan here suggested cannot be adopted conveniently maximum economy of steam should be obtained by an expansion, gear in which as in locomotive valve gear, increased expansion is accompanied by increased compression, but without that serious throttling along the steam line which usually characterizes the distribution by the link-motion.

The best among existing forms of valve gear should be, if judged from the standpoint here taken, that which—combining a variable expansion with a variable compression—is also capable of prompt and exact adjustment by a sensitive and efficient governor.

The economy to be expected from the suggested change in methods of regulation of the steam engine will evidently be dependent upon the manner of operation of the engine. Where engines have a nearly invariable load, and when they are well adjusted to their work, the advantage would probably be found inappreciable; but in cases in which the engine is much too large for its work or when the demand for power is very irregular, as in rolling mills or in rough weather at sea, and where cylinder condensation occurs to a great extent, the increased efficiency may be found to be very considerable. The gain by decreased internal condensation will, perhaps, often be found to be an item of no small importance.

Shipbuilding in Barrow.—The following is a list of the vessels launched from the Barrow Shipbuilding Yard, Barrow-in-Furness, during the year just past:—*City of Rome*, 8,500 tons; *Lismore*, 4,200; *Navarre*, 4,200; *Strabo*, 2,000; *Bearn*, 4,200; *Dredger*, 500; *Ganges*, 4,200; *Sutlej*, 4,200; *Rossall*, 200; and *Fenella*, 500; making a total of 32,700 tons.

An electric log has been invented by Mr. C. E. Kelway, and is known as the "Kelway Electric Log." The rotation of the log screw is made to complete an electric circuit a given number of times (regulated by the number of teeth in a ratchet wheel placed on the "mile" spindle of the log) in a mile, which, as now arranged, amounts to eight. At each completion of the circuit a current of electricity passes through the coils of a step-by-step counter, which forms the dial similar to a clock face. This dial being placed in the chart-room, captain's or engineer's cabin (or a dial may be placed in each, and worked from the same log), the distance run can be read off at any moment, and the actual speed of the ship known at will.

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* The writer has devised methods of automatic readjustment of the ratio of expansion when variations occur in the steam pressure, which methods would, in the case here taken, replace the usual adjustment by the governor

† History of the Steam Engine: D. Appleton & Co. (International Series N. Y., 1878, p. 473, foot note.

THE EADS' SHIP RAILWAY.

THE question of giving substantial support to the project for transporting large vessels by rail across the Isthmus of Tehuantepec, according to the plan advocated by Captain Eads, will shortly again engage the attention of the Congress of the United States of America.

As our readers are well aware, the idea of reaching the East by way of the West has long been a prevailing one in the minds of both navigators and traders, and the actual suggestion of a ship railroad dates back to the time of Cortez, in the early part of the sixteenth century. In the year 1814, Spain, after prolonged consideration, gave the project her consent, and authorized the construction of a railway. The scheme, however, lapsed, and since then, notwithstanding that the United States Government was prepared to pay fifteen million dollars for right of way, nothing further has been done.

More recently surveys have been made on several different occasions, for the purpose of determining the practicability of constructing a canal, and it really seems as if the actual commencement of the canal through the Isthmus of Panama had at last awakened the Mexican Government to take definite and decisive steps.

The Isthmus of Tehuantepec is situated at the extreme south of Mexico, about 1,200 miles north-west of the tract of the proposed Panama Canal, and at its narrowest part is 143 miles wide. As here the mountain ranges interpose no special obstacle, the Sierra Madre at three different points attaining only a height of about 650 feet, this locality has been selected by the projector as the one offering the fewest difficulties in the carrying out of his work.

The ship railway of Captain Eads is designed on precisely the same principle as the ordinary shipways for repairing vessels; only, as the speed of transit is intended to be much greater than the rate of hauling usually adopted at shipways, both the cradle and ways will necessarily be somewhat modified in strength and construction. The cradle is to be of wrought iron, about 300 feet long, with 1,200 wheels, running upon 12 lines of rails, the total load per wheel being not more than 5 tons when conveying a vessel weighing 4,000 tons. The rails are to be of steel of the usual railway section, laid at slopes of from 1 in 100 to 1 in 30, and they are to be carried into the water at each end, at such inclination and to such distance as to afford sufficient depth for readily floating vessels over the cradle.

When a ship is to be taken up, the cradle will be run down to the desired depth in the water by its own weight and the vessel guided into position by ropes carried to capstans on piers at either side. The cradle will then be gradually hauled up the incline by stationary engines, the ship all the time settling down on bilge and other blocks provided to receive it. So soon as it is fairly out of the water, two pairs of specially powerful locomotives will be attached, and will transport the cradle, with its load, across the isthmus to the other side, where the vessel will be immediately launched into the water and be ready to resume its voyage without further delay or loss of time. There will of necessity be no curves in the track, changes of direction being accomplished by turntables; and it is expected that the whole distance of 143 miles will be traversed in about 12 hours. This time, however, need not be lost, for, the moment the vessel is out of the water, gangs of cleaners and painters may be set to work on the hull. and any light repairs, either to the vessel or to the machinery, may be carried out during the journey.

From this slight description it will be seen that the engineering difficulties are not such as are likely to place any great obstacle in the way of the successful carrying out of the undertaking, providing the site has been selected with care. Great strength must, of course, be provided, and great stability of ways. With this, and careful proportioning of parts, the matter merely resolves itself into the construction of six lines of ordinary railway side by side, having one large truck common to all. That the ship, if properly secured, is not likely to sustain any injury, is obvious, when it is remembered that Lloyd's rules require every sea-going vessel to be so strong as to be capable of being supported on a single bearing at the centre of its length, or between two supports at its ends, without being strained in any part beyond limits of safety.

The concession which the Mexican Government has granted to Captain Eads is a liberal one, and the terms are such as will probably enable him to engage the patronage and assistance of the United States Government. This is the question which is shortly to be submitted to Congress, though if, as is stated, a rebate in the transit dues will be made to all United States ships, so as to allow them to compete on more favourable terms against English carrying vessels, it is highly probable some arrangement will be come to. On the other hand, however, if the railway is to be a commercial success it will have to be kept in view that American vessels paying reduced dues are not likely to provide dividends for the shareholders, who, if they are to be dependent upon foreign, and especially British, ships for support, would find that, in the long run, it would be more to their advantage to offer them inducements instead of attempting to make them pay for the transit of United States vessels by imposing increased dues.

The period for construction of the work is put down at about five years, and the total estimated cost at seventy-five million dollars, or, at the rate of half a million dollars per mile; figures which, from their great magnitude, render it extremely important that the commercial aspect of the scheme should be thoroughly well considered. To the British shipowner any safe method of expediting and shortening the voyage to the far East must be welcomed, provided the advantage be not counterbalanced by a much increased cost; but, with the rapid strides now being made in regard to the sizes of steam vessels in this country, we would point out that a total weight of vessel and cargo of 4,000 tons, which, we believe, is what the projectors intend providing for, is not nearly sufficient. If our carrying is to be done by the large ships. such as are now being built for our principal lines, 6,000 tons, or even more, will be reached; and, if capacity for this weight is not given, we very much fear that, by the time the railway is opened, it will be quite useless for the conveyance of our principal traffic.

INSTITUTION OF CIVIL ENGINEERS.

SIR W. ARMSTRONG ON NATIONAL DEFENCE.

AT the ordinary meeting on Tuesday, the 10th of January, Sir W. G. Armstrong, C.B., F.R.S., delivered an inaugural address as President.

He observed that it had been the practice of his predecessors in the chair, to select topics for their address that had reference to branches of engineering which operated to increase the productiveness of human industry, and there were many who would contend that all engineering efforts ought to centre upon that object. It might be fully admitted that the general amelioration of the material condition of the world was the noblest object of engineering science; and if men and nations ceased to be bellicose and rapacious, such would naturally be the direction which all engineering practice would take; but this was a world of contention, where no individual state could insure its independence, and carry on its industrial occupations in safety, without protecting itself against the possible aggression of its neighbours. Thus it was that the science of the engineer was invoked for the purposes of war as well as for those of peace; and it was probable that the engineering element would in future enter more and more largely into the operations of war, until the issue would be chiefly dependent upon the superiority of mechanical resource displayed by one or other of the contending parties. There was no country in the world less disposed to be aggressive than our own, but there was none so likely to incite the greed of an assailant, or so vulnerable in relation to its commerce. War indemnities had degenerated into mere exactions proportioned to the wealth of the vanquished; and England, being the richest of nations, offered the highest premium for successful attack. As to commerce, England had more than one-half of the ocean carrying trade of the whole world in her hands, and her ships, swarming over every sea and conveying merchandise of enormous value, would, in the event of war, invite the depredations of hostile cruisers. We had seen in recent years what ravages a single-armed ship could inflict upon a mercantile navy incomparably smaller than our own, and, in our case, it was not only property, but indispensable food that was at stake. The ever-increasing population of Great Britain had already far outgrown its internal means of support, while the increasing cheapness of imported food so discouraged native agriculture, that we might expect our future dependence upon foreign supply to increase even more rapidly than our population. This was not the occasion to discuss either moral questions affecting war, or political questions concerning free trade. We had the stern fact before us that national defence was in our case peculiarly a necessity, and the question how it could best be effected, from an engineer's point of view, was a legitimate subject for this address.

England must always be chiefly dependent for security upon her naval power, but we could not hope that she would ever again be so dominant at sea as before the introduction of steam navigation. So long as naval superiority depended upon seamanship and an unlimited supply of sailors, no nation or combination of nations could compete with us; but as soon as it became established that fighting ships could be manœuvred with more certainty and precision by the power of steam than by the power of wind, a revolution began which had gradually made naval warfare a matter of engineering rather than of seamanship. The introduction of rifled ordnance and percussion shells was the second step in this revolution, and had the effect of condemning as useless the whole fleet of wooden ships with which all our victories had been won, and which were the pride of the nation. Then commenced that contest between guns and armour which had gone on to this day, and had not yet been decided. Nor would it, in all probability, ever be decided, seeing what an *ignis fatuus* finality was. The most recent stage of this revolution was that marked by the introduction of torpedoes, against which our ponderous ironclads were no more secure than ships of thinnest iron. These constantly-changing phases of attack and defence had placed our naval authorities under extreme difficulty in deciding upon questions of ships and armament. To stand still was impossible, while to act upon uncertain data was sure to lead to mistake. The necessary consequence had been that types and patterns of ships had been continually changing, and vessels, costing vast sums of money, had become nearly obsolete almost as soon as made. We could not wonder that, so long as invulnerability was conceived to be attainable, great sacrifice should be made for its accomplishment; but with our present knowledge, which it would be unfair to apply to a criticism of the past, we might feel assured that invulnerability was a chimera. Not only did we see that armour was unavailing against torpedo attack and ramming, but we were justified in concluding that every attempt to increase resistance to projectiles would be quickly followed by a corresponding increase in the power of artillery. Our early ironclads, like the Warrior, were plated all over with armour 4½ in. thick—a thickness which could now be pierced with field-pieces. To resist the most powerful guns now afloat, armour of at least 2 ft. in thickness was required; and in order to reconcile the constantly increasing thickness with the weight which the ship was capable of carrying, it had been necessary to restrict the area of armoured surface to ever narrowing limits, leaving a large portion of the ship without protection. In those magnificent and tremendous vessels which the Italians were now building, the armour would be withdrawn from every part except the battery, where guns of 100 tons would be placed, and where the armour would be confined to a narrow belt of great thickness. Everything of importance that projectiles could destroy would be kept below water-level, and, so far as artillery fire was concerned, the ships would be secured against sinking by means of an under-water deck and ample division into compartments. Armour therefore seemed gradually contracting to the vanishing point; but, until it actually disappeared, it was probable that no better application of it could be made than had been decided upon by the acute and enterprising naval authorities of Italy for the great ships they were now constructing.

The dread of the terrible effects of the fragments of shells bursting amidst a crowded crew, and the apprehension that the smoke from the explosion, when it occurred between decks, would paralyse the service of the guns, had conduced more than anything else to the adoption of armour. Methods of avoiding or lessening these dangers, otherwise than by the use of armour, had been little considered; yet the alarming aspect of the case was greatly altered when we reflected that, by the application of mechanical power, to do what had hitherto been done by a multitude of hands the exposure of a crowded crew could be avoided, and also that the guns might all be mounted on an open deck, where the smoke from shells would speedily clear away.

As to the comparative liability of an ironclad and an unarmoured ship to be sunk by projectiles, there was much less difference between them than was generally supposed; because the unarmoured ship, though freely penetrable, might be so constructed that the entrance of water by perforation would not extensively flood the ship, unless it took place at a great number of critical places. Indeed, by introducing an underwater deck, with divisional spaces, and by the partial application of cork, as in the *Inflexible*, for displacing influent water, and thereby preserving stability, and also by a proper distribution of coal for the same purpose, an unarmoured ship might be rendered almost incapable of being sunk; and it was rather surprising that so little attention had been directed to the attainment of that object.

It was not too much to say that, for the cost of one ironclad, we could have three unarmoured ships of far higher speed and carrying collectively three armaments, each equal to that of the armoured vessel. It might be asked, Which would be the better investment? If it were imagined that the three were matched in combat against the one, it would be perceived that, in addition to their numerical superiority, the former would possess many advantages. Being smaller, they would be more difficult to hit. Being swifter, they could choose their positions, and be free to attack or retreat at pleasure. Being more nimble in turning, they would be better adapted both for ramming and for evading the ram of their adversary. Finally, the conditions of superior speed and agility would favour their use of torpedoes and submarine projectiles; although it was a question whether, for the sake of a much-needed simplification, it would not be better to confine that species of attack to separate vessels specially constructed for that one particular purpose. Even if the utmost advantage she could possess were conceded to the ironclad, viz., that of being impenetrable by the guns of her opponents—she could not prevail in a contest of three against one, unless, by the use of securely-protected artillery, she could keep her assailants at bay, and gradually destroy them by her fire if they persisted in their attack. Such might be the issue if the allied vessels had nothing but guns to oppose to guns; but they would naturally, under such circumstances, place their men below, out of the reach of projectiles, and then attack with their rams or torpedoes. With the crews in safety, it was scarcely possible that unarmoured vessels, with under-water decks and all their machinery beneath, should suffer any disabling injury by being pierced in a few places by either shot or shell. But, take the much more probable alternative of the armoured vessel being penetrable by the guns which would be used against her. In that case her enemies might elect to make the contest one of artillery. On their part, armour-piercing projectiles would be used which, on penetrating the thick sides of the ironclad, would carry inboard a mass of broken material far larger in quantity than the fragments of the shells with which they would be assailed, and quite as destructive in effect. The ironclad would have to sustain the converging fire of three ships, each carrying the same armament as her own, and her swift and nimble adversaries would steam round and round her, directing their fire on the most vulnerable points, and ever ready to seize a favourable moment to dash in and finish the contest by ramming. In either case, therefore, the ironclad would be overmatched by a combination of unarmoured vessels representing the same pecuniary value. Without entering into technical questions concerning fleet-fighting, it seemed reasonable to believe that the result would be the same if the number engaged on each side were proportionately multiplied. Inferiority of speed and of number would still give the choice of position, and secure the advantage of converging fire; besides which, the greater power of division and of concentration must always belong to the more numerous fleet. But, if ironclads were not needed for the purpose of opposing ironclads, it was difficult to see for what purpose they were wanted at all. For every other kind of service, a numerous fleet of smaller and swifter vessels, unencumbered with armour, would clearly be preferable. To protect our commerce, to guard our extensive seaboard against invading flotillas, to lend naval assistance to our colonies in case of need, and generally to maintain our supremacy at sea, we required a far more numerous navy than we possessed or could afford to possess unless we vastly reduced our expenditure on individual ships, and to do this we must dispense with armour. It might, perhaps, be rash entirely to abandon armour so long as other nations continued to use it, because nothing but the experience of an actual war would remove all question as to its possible utility; but, considering the indisputable value of a numerous fleet of swift and powerfully-armed ships, built with a view of obtaining the maximum amount of unarmoured defence, and, considering that such vessels, unlike armour-clads, could never grow much out of date, it did seem to be expedient that the chief expenditure of this country should be upon ships of that description. Lightness should be the special aim in the construction of such vessels. Steel plates should be used for the hulls, and guns and engines should be of the least possible weight consistent with the necessary power. Every ton of weight saved would enable higher speed to be attained, and there was probably no quality in a fighting ship which would so much develop in importance as that of swiftness. Messrs. Thornycroft has led the way in showing what extraordinary speed could be realised in diminutive vessels, by reducing to the utmost the weight of every part of the structure and its contents; and, although we could not expect to attain proportionate speed by the same method in ocean-going ships of war, yet there could be no question that we might have far swifter ships than at present if lightness were made the principal object, instead of the prevalent practice of loading ships with cumbrous armour, in the vain hope of rendering them invulnerable. Light unarmoured ships, designed by Mr. George Rendel, had lately been built in this country for foreign powers, which, with a displacement of only 1,300 tons, had attained a speed of 16 knots an hour. They carried coal for steaming 4,000 miles, and had already actually steamed 3,500 miles without replenishing. They were each armed with two 10-in. new-type guns, which had nearly an all-round fire, and were capable of piercing 18 in. of iron amour; and with four 40-pounders on the broadsides. It was a very serious question what could be done in the event of a number of such vessels as these being let loose upon our commerce. At present there was not a single ship in the British navy carrying an armament competent to engage them, that could overtake them in pursuit, or evade their attack when prudence dictated a retreat. Confidence was often expressed in our mercantile marine being capable of furnishing, on an emergency, a supply of vessels fit to be converted into cruisers; but where were there to be found amongst trading or passenger steamers, vessels possessing a speed of 16 knots, with engines and boilers below water-level, and having an under-water deck to save them from sinking when penetrated by projectiles at or below the water-line? From his own experience he knew how difficult it was to adapt mercantile vessels to the purposes of war, and how unsatisfactory they were when the best had been made of them. It was alarming to think how unprepared we were to repress the ravages which even a small number of swift marauding vessels, properly constructed and armed for their purpose, could inflict upon the enormous property we had at all times afloat, and how little we could hope to clear the sea of such destructive enemies, by cruisers improvised out of ready-made steamers destitute of all the conditions necessary to render them efficient for such a service. It must ever be borne in mind that it was not merely the loss of property and interruption of trade that we had to fear, but also the interception of food supplies; and that the more our population increased and our agriculture declined, the more terribly effective for reducing us to submission, would be the stoppage of those supplies.

The President then adverted to harbour defence. He pointed out that many of our ironclad forts had already outlived the stage of artillery progress for which they were adapted. He expressed his opinion as to the best method of rendering large guns effective in shore batteries. He dwelt upon the value of gun-boats, considered as floating gun-carriages, and used in combination with torpedo craft and submarine mines; all of which, he suggested, might be committed to the management of trained naval and engineer volunteers resident on the spot.

He said it would be a grand development of the volunteer movement, of which this country was so justly proud, if it were thus to be extended to harbour defence; and he was informed that, so far as the use of submerged torpedoes was concerned, a project of intrusting their employment to a corps of volunteer engineers was already under consideration. The superior education and intelligence of the class from which our volunteers were mostly supplied would especially fit them for the discharge of duties involving skill and discretion, such as would be required in the handling of electrical apparatus, and we might be sure that, wherever dash was needed in the use of torpedo boats, there would be no lack of that quality amongst volunteers in the hour of trial.

On the subject of artillery, he described the progress of gun manufacture since the introduction of rifled ordnance, prior to which a gun was simply a tube of cast iron or bronze closed at one end. He also discussed the question, what, under the present conditions and prospects of steel manufacture, should be our practice as to the use of that material for artillery purposes. He was then led to speak of a system of construction which had not passed through the experimental stage, but which, from the results it had already given, promised to attain a wide application. He referred to that system in which the coils surrounding the central tube consisted of steel wire, or ribbons of steel, wound spirally upon the tube. To those who objected to welded coil tubes on the ground of supposed deficiency of longitudinal strength, this mode of construction must appear especially faulty, inasmuch as lateral adhesion instead of being, as contended, merely deficient, was altogether absent, while to those who advocated the present coil system, this variety must commend itself as affording the greatest possible amount of circumferential strength that could be realised from the material employed. Steel in the form of wire, or drawn ribbon, possessed far greater tenacity, and also greater toughness, than in any other condition, and in applying it to guns there was perfect command of the tension with which each layer was laid on. He then alluded to the labour of those who had worked in this direction, and referred to a 6-in. breechloading gun of this construction made at Elswick, and tried in the beginning of 1880. He stated that the charges used with it were large beyond precedent, and the energies developed proportionately high. Being satisfied with the results obtained with this gun, a second one of larger dimensions had been commenced, and was now finished. Its calibre was 26 centimetres, or about 10¼ in. Its length was 29 calibres, and its weight was 21 tons. In the previous gun he depended for end strength upon the thickness of barrel only; but in the new one, layers of longitudinal ribbons were interposed between the coils, in the proportion of one longitudinal layer to four circular layers. The longitudinals were secured to the runnion ring at one end and to a breech-ring at the other, and were in themselves calculated as sufficient to resist the end strain on the breech, independently of the strength afforded by the tube. The whole was encased in hoops shrunk upon the exterior of the coil, for the treble purpose of protection from injury, of preventing slipping in the event of the failure of an external strand, and of adding to the strength of the gun. This gun has already been tried, and had given results which in relation to its weight, were unexampled, except by its 6 in. predecessor. Various attempts had also been made abroad to reduce this system to practice, and it was understood that the French were at present engaged in making experimental guns upon the same general principle. With regard to the ribbon form of section, he preferred it to a square section of equal area, as being more favourable for bending over a cylinder, but any rectangular form was better than round wire, on account of the flat bedding surfaces it afforded.

He then discussed the subject of breech-loading and muzzle-loading, and the various forms of rifling. He also described the many changes that had been found necessary in the form and manufacture of powder for heavy ordnance, and the difficulties which still remained to be overcome.

As to the mounting of guns in forts and ships, he remarked that the difficulties of the problem were much greater than was commonly supposed. It was certain that machinery could be no longer dispensed with for working the guns, and that engine power must be used to economise labour and avoid exposure of the men. In the days of cast-iron smooth bores, the heaviest naval gun weighed 95 cwt., and it was deemed impracticable to exceed that limit in a ship. At the present time, the heaviest naval gun in the British service was 80 tons, and guns of 100 tons were carried in Italian ships. Instead of projectiles weighing as a maximum 94 lb., and charges of 16 lb., we had now to handle projectiles of 1,500 lb. and charges of 450 lb.; and to keep pace with foreign navies those limits of weight must be greatly exceeded. Even if it were possible to deal with guns and ammunition of such weights by manual labour, the multitude of men required for the purpose would be greater than could find standing room at the guns. Up to a certain point hand power might be so aided by machinery, as to enable larger guns to be worked by men than was formerly deemed possible; but the mechanism required to render hand power available was quite as liable to be disabled by an enemy's fire as that which would be applied in connection with engine power. There was, therefore, no reason in this respect for employing a numerous gun crew in preference to inanimate power. Automatic methods of varying out the gun, by which the gun was lifted in recoiling by slides or radius bars and recovered its position by gravitation, might in many cases be advantageously used to save labour, but in a ship the varying inclination of the deck interfered with uniformity of action. The upward motion of the gun also involved the objection of a higher port, and it added greatly to the downward shock, which became very severe on the deck where the guns were large and were fired at considerable elevation with such heavy charges as were now usual. Steam power, acting through the medium of hydraulic pressure, was already largely applied in recent ships for effecting all the operations of working the guns, and where such power was used there was nothing to gain by automatic action for returning the gun into firing position. In considering these various mechanical arrangements now applicable to naval warfare, we perceived the growth of the engineering element in our ships of war, and the importance of mechanical, as well as nautical, acquirements on the part of the officers, as also, in a less degree, on that of the men. Breechloading guns, carriages fitted with all modern appliances, shot and powder lifts, mechanical rammers and torpedo apparatus, all combined with steam or hydraulic machinery, or with both, constituted mechanisms requiring to be supervised by officers qualified as engineers, and to be handled by men trained in the use of machinery.

Before drawing to a conclusion he would advert to a subject of grave national importance. Our Navy was at present armed with guns which could not be expected to contend successfully with the best modern guns that could be used against them. Happily, most of the older ships of foreign powers were in the same predicament; but all their new vessels, and some of their older ones, were being armed with artillery which, weight for weight, was far superior in power to that of our Navy. Our service guns had simply been overtaken in that rapid progress of artillery which had been going on for the last eight or ten years; and it might be doubted whether any partial remodelling during that period would have averted the present need of re-armament; while it would certainly have involved great sacrifice and confusion of ammunition and stores. But a new departure could not longer be delayed. An irresistable demand had arisen for breechloading guns, and it was imperative to combine, with the introduction of that system, such other modifications of construction as would realize the increase of power which we now knew to be attainable.

It might, however, be asked, What better prospects of finality there was now than we had ten years ago? As to absolute finality, it would probably never be reached, but the country might take some comfort in the reflection that every stage of progress narrowed the field for further development. There was already no substantial room for improvement in the accuracy of guns; and as to power, we were nearly approaching the limit at which severity of recoil and extravagant length of gun would prohibit further advance. We might go on building larger guns almost without limit, though he doubted the policy of so doing, but mere increase of size did not revolutionize system. There seemed, therefore, to be more hope of permanency now than at any former period; but whether this were so or not, we could not, with danger, remain passive.

What, then, should our Government do in regard to the great work of re-arming the fleet? He took it for granted that all new ships would be armed with the best guns that could now be made, and that the more important of the older vessels would speedily receive the same advantage; but beyond this, so long as experience of novelties was deficient, it was a case for cautious procedure. In the mean time, no expense should be spared in judicious experiments, seeing that the expense of experiments was trifling in comparison with that of mistakes. Above all, the Government should pursue such a course as would bring into full play the abundant engineering resources of this highly mechanical country, for increasing the efficacy of our national defences.

OUR ROYAL MARINE ENGINEERS AND ENGINE ROOM ARTIFICERS.

(*Continued from page* 225.)

At the time referred to the cabin accommodation of the marine engineer was considerably increased, and a recognized officers' mess established for them as a body similar to the sub-lieutenants and midshipmen's mess. At the same time a little more freedom existed in the intercourse of the 2nd, 3rd, and 4th engineers, and the non-commissioned and lower grades of commissioned Royal Naval Officers. At this time also the sloops, corvettes, frigates, two deckers and three deckers, the wooden walls of old England received their death blow, and with their lofty spars and clouds of canvas quickly disappeared. In their place came the *Warrior*, *Black Prince*, *Defence*, and numerous other iron armour clads with heavy and massive hulls and comparatively limited areas of canvas. From that time till the present the duties and uses of the sailor and sailor officer of former days has decreased considerably, and in the same ratio those of the royal marine Engineer and stoker have increased. The simple propelling paddle, or single screw-engine of a comparatively auxiliary nature, referred to as the first introduction of steam power in our Navy, is now replaced by massive and complicated twin screw, surface condensing, high and low pressure engines, as well as powerful single screw, and in some cases paddle engines.

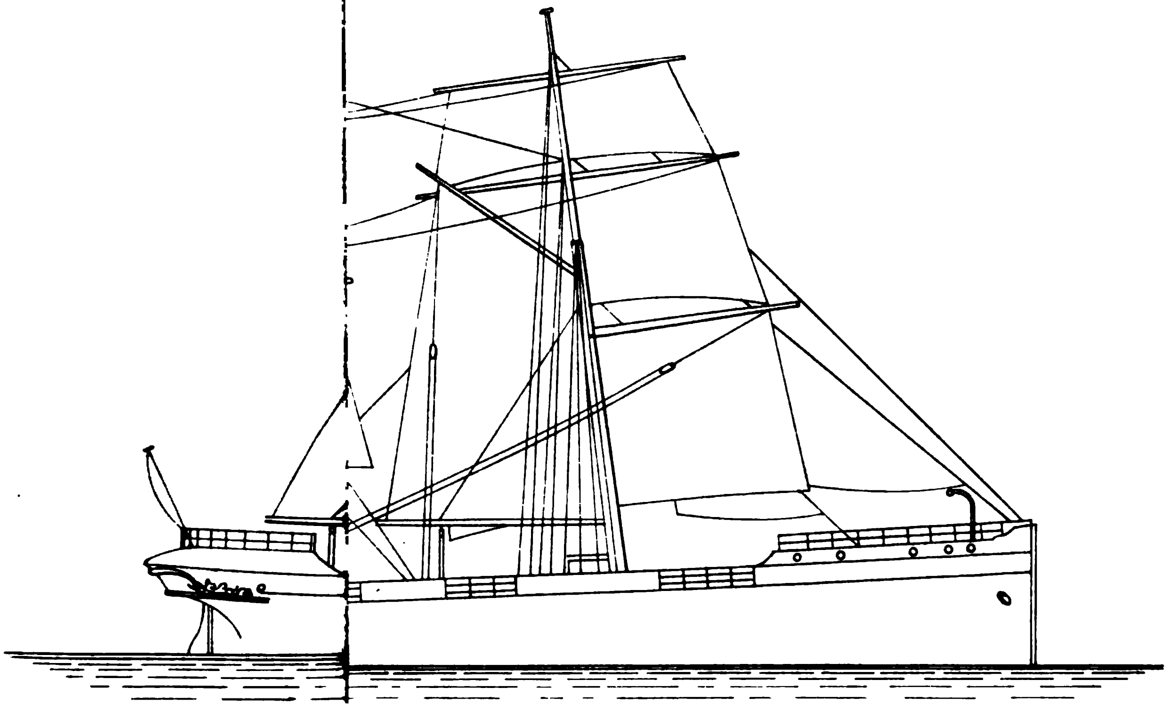
The construction and nature of these engines require the care and attention of the most highly skilled marine engineers to such an extent, that the more practical details requiring manual skilled labour which could be carried out by engineers less highly trained, has led to the appointment of a class of working engineers termed engine room artificers. Not only has the marine engine of our man-of-war developed into a large complication of massive machinery of highly skilled design, but the stupendous complications of engineering skill embodied in our modern man-of-war calls for the appliance of machinery to work nearly every portion of the structure. This is carried out either by gearing from the main engine or from auxiliary engines fitted up in different parts of the vessel. Turrets, guns, capstans, pumps &c., are worked by machinery, the anchor is hove up by machinery, and in the case of vessels being rigged the severest strains brought on tl
set up by machinery. The cutters, pinnaces and to
carried by our men-of-war are propelled by means of s
engines of delicate structure requiring the greatest skil
tion. The progress of marine engineering science ha
itself to such an extent that at the present day very lit
paid to the rig of our man-of-war, in fact many of our n
armour clads are mastless, thus showing that sails as
agent even in the most auxiliary degree may be dis
altogether. This has further reduced the number and
blue jacket and the sailor officer, and respectively in
value of the royal marine engineer, naval artificer, and s
royal marine engineer apprentice of the past is now
the engineer student in our royal dockyards. The yo
to follow this profession only obtains his appointment
or gentleman apprentice by successfully passing a high
petitive examination. In order to be fully fitted for th
youth intending to become a candidate has to be spec
from the commencement of his education, which mu
highest order, and necessarily of an expensive nature. A
his appointment as an engineer student it is only by
application and study that he can hope to rise in his pi
pass higher class examinations in practical and theore
engineering when he is allowed to finish his studies
man-of-war, wearing a uniform and holding a positio
similar to that of a cadet graduating for the post of a c
officer of the Royal Navy.

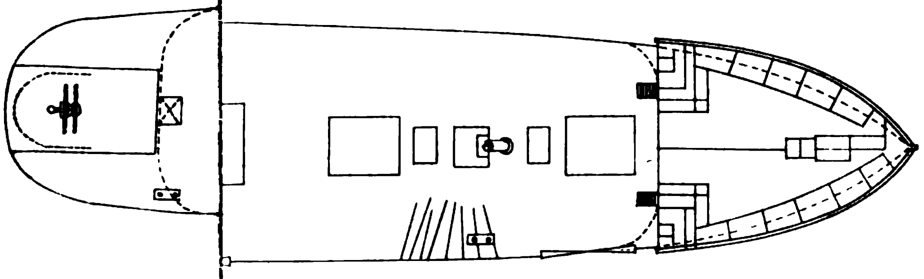
The expense attending the education of a youth p
his maiden examination, combined with the extra exp
cation and uniform whilst graduating as an engineer
only be borne by parents in a good position in life wh
of education reached by the royal engineer before he
a full appointment in the Royal Navy entitles him t
gentleman. Considering that commissioned navigatin
charge of the seamen and navigating arrangements of
war can only receive a good education and graduate
way, it is not a matter of surprise that the engineers
hard to fit themselves to take charge of the complicate
the different parts of a ship, and to direct the num
room artificers and stokers who are so quickly sup
seamen in many of the requirements of a man-of-war,
to be recognized as officers and gentlemen of positi
reviewed generally the introduction of the royal mar
into our navy, the gradual development and value of t
auxiliary engines employed in our ships, togeth
increased knowledge and higher class duties required of
it would appear that his position as regards remu
status should be on an equal footing according to t
bestowed on the other offices of the ship. At a fu
will show how far this is now carried out. It is evid
position of the royal marine engineer has improved ve
it is a question if more still remains to be done. We
paring the increase of pay gradually brought about by
nized position from the time of the introduction of th
our navy with that of commissioned officers, endeavour
exact position in which our royal engineers now sta
facts which would be convincing as to whether the am
sideration they merit is meted out to them, or whether,
hand, their case at present is such an aggrieved one,
general expression of feeling now in existence they a
believed to occupy.

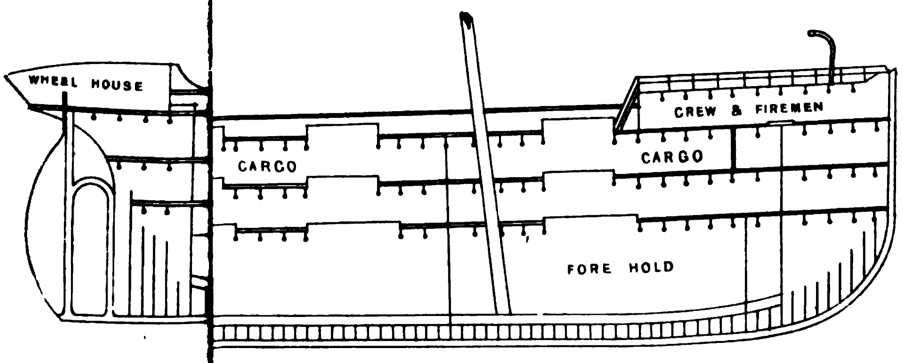
(*To be continued.*)

THE steamship building-yards on the Tyne seem
whelmed with business. The following are some of
Messrs. C. Mitchell & Co. are fitting out vessels in
they have seven new ships on the stocks, and they
the keels for two others shortly. Messrs. W. Richa
are busy with four steamers. Messrs. Schlesinger &
also four boats on hand. Messrs. Leslie & Co. have
Palmer & Co., of Jarrow and Howden, are full of
Tyne Shipbuilding Co., at Wellington Quay, are buil
for local owners. Messrs. Redhead & Co., of the
South Shields, are as busy as ever turning out new sh
T. & W. Smith, North Shields, have orders in their
it is expected will keep their yard well employed for
months. Messrs. Campbell & Boustead, of Scotsw
able to give a good report of work on hand, and of p
the year.

DEE.






WHEEL HOUSE
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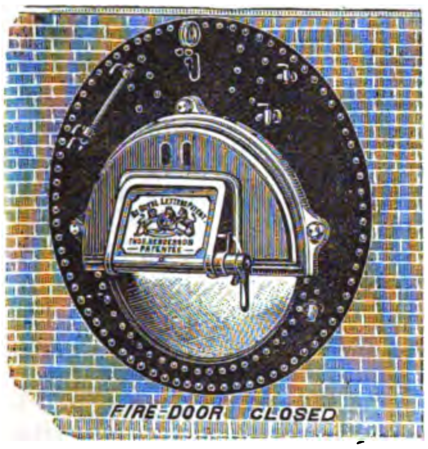
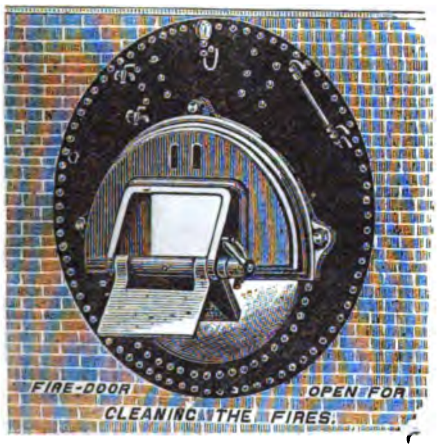
CARGO
FORE HOLD

HENDERSON'S PATENT FIRE-DOOR.

IN connection with the Smoke Abatement Exhibition, now being held at South Kensington Museum, considerable interest has been caused through the energetic and business-like efforts of the committee in drawing together many useful and ingenious appliances, with the object of facilitating the prevention of smoke, and the saving and utilizing to the utmost extent, coal and its products during combustion. It is also satisfactory to find that the public as well as the exhibitors appreciate these efforts by attending in such force.

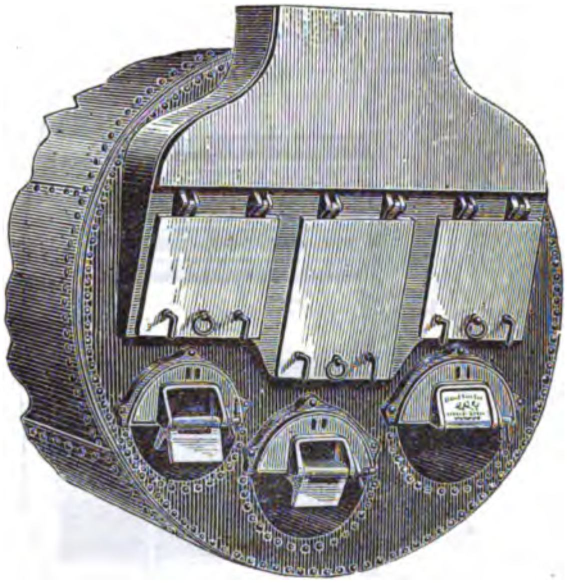



FIRE-DOOR OPEN FOR CLEANING THE FIRES.

Amongst the many exhibits, we here give a description with explanatory illustrations of a simple and ingenious arrangement of fire-door, which has been gradually gaining in favour for these last few years. That of Henderson's Patent Fire-door, invented and patented by Mr. Thos. Henderson, of Liverpool, whose name has long been coupled with the manufacture, &c., of mechanical stokers and matters pertaining to the combustion of fuel generally.

The fire-door itself is of a ∠ shaped form, with the hinge at the point of the angle, and, unlike other doors, is placed at the bottom, in line with the dead plate or underneath the fire-door opening, and not at the side as is usually done.

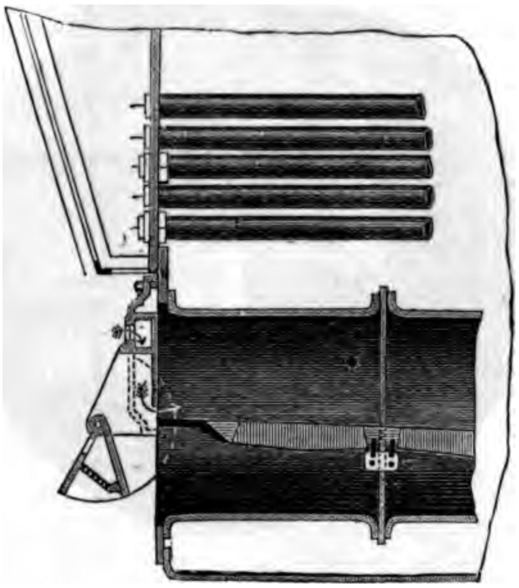
This angle-plate or door swings between two side cheeks or projections from the casting forming the furnace front. When the door is closed, the lower leaf of the angle-plate is in line with, and forms part of the dead plate. When the door is pushed inwards, so as to open the door for firing &c., the top or upper leaf falls into the position previously occupied by the lower leaf, in line with the dead plate, while the lower leaf falls down below to a corresponding angle to serve the double purpose of protecting the stoker's legs from the heat of the furnace, and to partly regulate the air, and also heat it previous to its admission under the bars.



When it is desirous to clean the fires or withdraw clinker, the angled door is simply pushed further in, in an inward direction until both leaves hang downward like the letter A. The clinker can then be withdrawn with the greatest facility, through the opening thus left between the door and the dead plate, without being scattered over the plates of the stokehole, while the position of the hanging door protects the fireman from the fierce heat of the withdrawn clinker, while from its formation it protects him also from the sulphur and suffocating fumes so deleterious to men in close stokeholes, especially in tropical latitudes, by directing the gaseous matters up through the opening formed by the vacant plate, and thus keeping the stokehole ventilated. The door is nicely balanced so that it can be easily moved into any required position by a handle at the side for the purpose

This simple fact of its being so easily opened and closed surprisingly illustrates to the observer how greatly it facilitates and eases the work of the generally overwrought stoker. An air chamber is cast in the furnace front for the double purpose of keeping the front cool, and for heating the air passing through it to the furnace. The back plate of furnace front, as also a plate cast on, and at right angles to the lower leaf of the angled door, is perforated for the admission of air, which can be regulated as required for the prevention of smoke by a slight movement of the door itself.

The illustrations show the Patent Fire-Door as fitted to an ordinary Cornish boiler, one view showing the door when closed, and the other when in the position for cleaning the fires, and also as fitted to a three flued marine boiler; the three furnaces showing respectively the positions when closed, when firing, and when full open for cleaning. The two views illustrating longitudinal sections of the furnace represent the door when in position for firing, and when in position for cleaning, and the direction of the air currents.

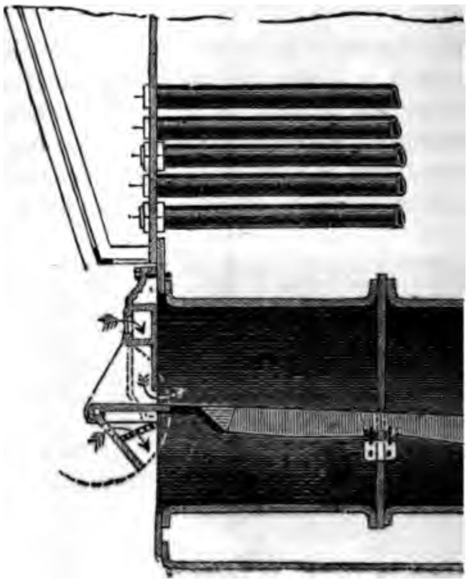


These fire-doors have been, and are being, fitted to several vessels in the Atlantic and East India trade, including the "Allan" Line, the "City" Line, the "Wilson" Line, and the "Temperly" Line, &c., of steamers, as also at Messrs. Clark's Thread Mills, Glasgow, Messrs. Leitch's Sugar Refinery, Liverpool, Messrs. Goodman Brothers' Works, Bermondsey, and many others.

We herewith append an experimental test for smoke, taken in London during December last, with a Cornish boiler fitted with the above apparatus.

Test of boiler fitted with Henderson's **Patent** door and front, December 23rd, 1881.
Coal weighed 5 cwt. or 560 lbs.
Furnace grate surface 2 ft. × 3 ft.
Commenced on a light fire, steam pre
22 lbs., time 3 hours 15 minutes.

Time. P.M.		Degrees.
1.0	Temperature	800° low fire.
1.10	"	1150° fresh full fi
1.20	"	1160°
1.30	"	1050° full clear fir
1.40	"	1125° steam pressu
1.50	"	1050° after breaki
2.10	"	1025°
2.20	"	1000°
2.30	"	1050°
2.40	"	1050°
2.50	"	1160° fresh full fir
3.0	"	950° clear fire.
3.10	"	1000°



Third tank, amount used, 17 ft. ¾ in.

3.20	"	1000°
3.30	"	1000°
3.45	"	1000°
4.0	"	900°
4.15	"	960°
4.30	"	925°
4.45	"	940°
5.0	"	900°
5.15	"	840°
5.30	"	900°

Water used from 4th tank 14½ in.
Finished at 5.35

Smoke Emitted.

1 at 1.50 on shaking up dull grey smoke 5 seconds.

2 1·50, thin light grey smoke, 5 seconds.

3 Smoke similar in appearance to steam.

1.40 5 seconds.

1.50 15 seconds.

4 Smoke Imperceptible.

P.M.	P.M.	P.M.
1.0,	1.10,	1.20,
1.30,	2.0,	2.20,
2.30,	2.45,	3.15,
3.30,	3.40,	3.50,
4.0,	4.15.	

Another test was recently made at the Sugar Refinery of Messrs. James Leitch & Co., by Mr. Donaldson, Consulting Engineer, of Liverpool. The range of boilers consists of eight double-faced Lancashire boilers, two of which are usually out of use for cleaning and repair, the six boilers in constant use consume on an average 35 tons of coal per 24 hours, which means continuous and hard firing; the test took place at 6 p.m. at the change of the day and night shift of men, the fires being cleaned twice during each watch, at the beginning and intermediate between the watches.

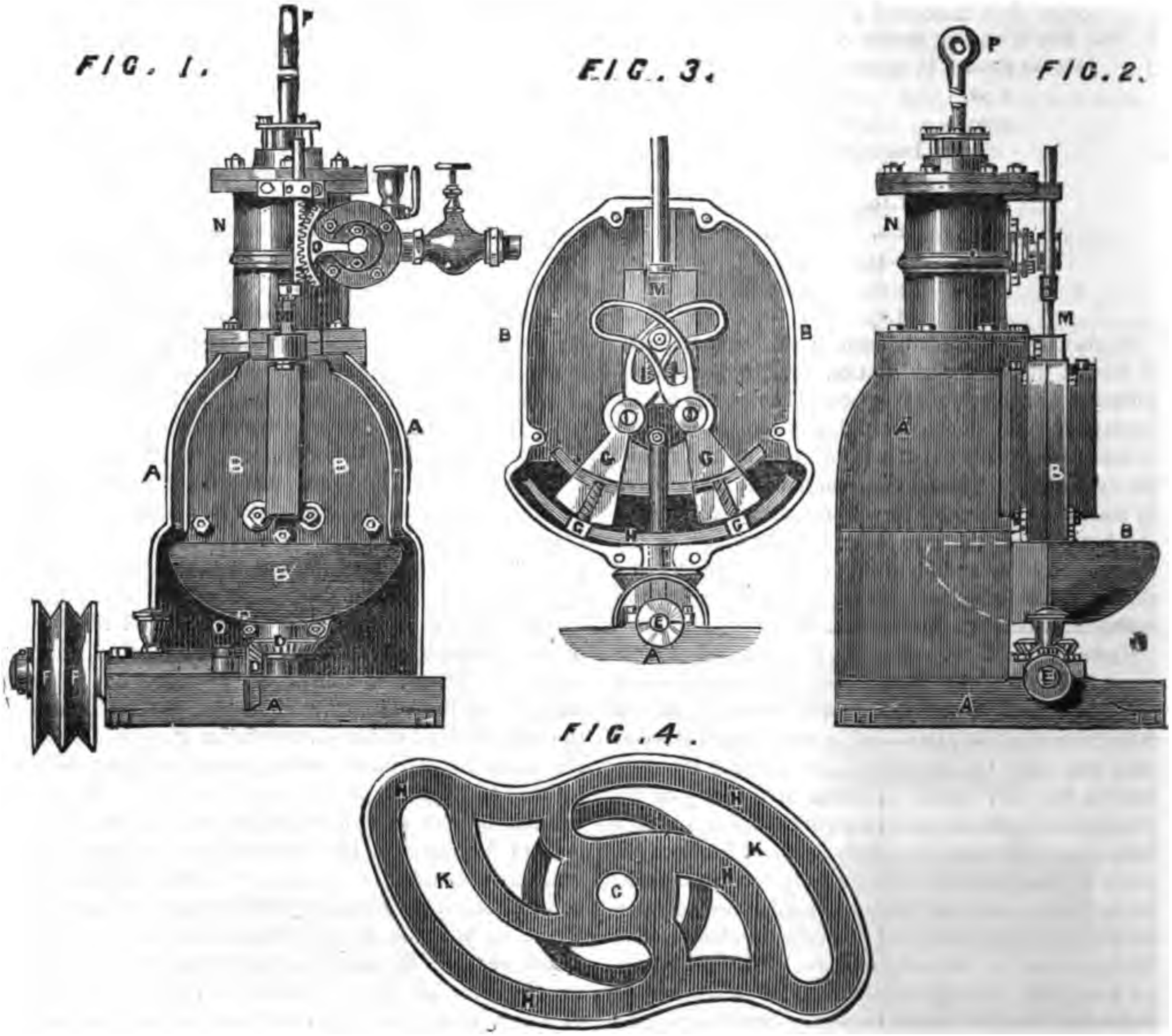
Upon the fresh men starting, six of the fires were cleaned and fired with fresh green coal as rapidly as it could be done. Upon the introduction of fresh fuel entirely covering the grate—and in one instance this was done with both the furnaces of one boiler at the same time—a dull grey smoke appeared at the top of the chimney, as it were shot up by a slight explosion, and then immediately died away, generally in about five seconds, and in no case after repeated trials more than ten seconds; during these intervals of firing the smoke was only perceptible as a slight haze, and generally the chimney had the appearance of not being at work. All these boilers are fitted with Henderson's Patent Fire-Doors, and we understand that the Smoke Inspectors have long ceased to trouble the proprietors of these works.

Altogether this simple arrangement of fire-door and furnace front, invented by Mr. Henderson is well worth the attention of those interested in the vexed question of Smoke Prevention, full sized models of which may be seen at South Kensington, as also, we understand, at the forthcoming Naval Exhibition, at the Agricultural Hall.

THE PATENT LIGHTNING-SPEED CHECK GOVERNOR.

AFTER the numerous steam governors that have been invented during the last ten years and the researches of so many eminent men into this department of engineering, we might naturally suppose that no further material improvement would be arrived at; however, we must admit that the one which we now present to our readers is, in every respect, worthy of our careful consideration. This governor, which was patented some time since by Messrs. Gibson & Nicholson, Engineers, Sunderland, seems on first sight to be complicated, but on a little closer examination its working, and the reasons for the use of its several parts will be more apparent. In reference to the illustrations, Fig. 1 represents the front elevation; Fig. 2, side elevation; *A* is a metal cover half enclosing the revolving case *B*, which is loose on the shaft *C* (is shown in Fig 3), which derives its motion from the pinions *D*, shaft *E* and driving pulleys *F;* Fig 3 shows the inside of the case enclosing the weights *G* (which move on the centres *I*), and the disc *H*, which is more clearly shown in the enlarged plan Fig. 4. The pins *G* project below the end of the governor balls (so called), and are made approximately to fit the slots *K*, in the disc with rollers on them to reduce friction. The springs *L* serve to prevent a too great movement from the action of the slots. The apparatus being thus arranged, it will be seen that by the action of centrifugal force on the rapid rotation of the governor case, the weights will tend to draw in the rod *M*, and to actuate the valve-rod *O*. The addition of the cylinder quickens the motion of the throttle valve-rod which is attached at *P*, by admitting the steam to the under or upper side of the piston in the cylinder *N*, as the case may be. As the rotation of the case increases in rapidity the arms tend to diverge, and like an ordinary governor, the weights will tend to diverge or come together in accordance with the greater or less speed of revolution. There is, however, by the arrangement of apparatus which we have described, a *second action set up*, due to the curve of the slot shown in Fig. 4, the effect of which is to assist the movement of the governor weights during any change of speed; thus, should the speed be suddenly accelerated, the curve of the slot is so proportioned, that the pin *G* will not attain the full amount of acceleration, if it should take a position more distant from its centre of revolution than it had before, and as the pin *G*, when not at its extreme stroke, is free to take this more distant position, it will naturally by its own inertia and the inertia of the balls tend to do so, and by this effort tend to disturb the previously existing equilibrium of the governor weight due to centrifugal force, giving the governor a very quick action. On the other hand, should the speed of revolution be suddenly diminished, as the pin *G* can take a more advanced position in the line of its revolution by an approach to its centre of revolution, the force of impetus will cause an effort to

FIG. 1. FIG. 3. FIG. 2. FIG. 4.

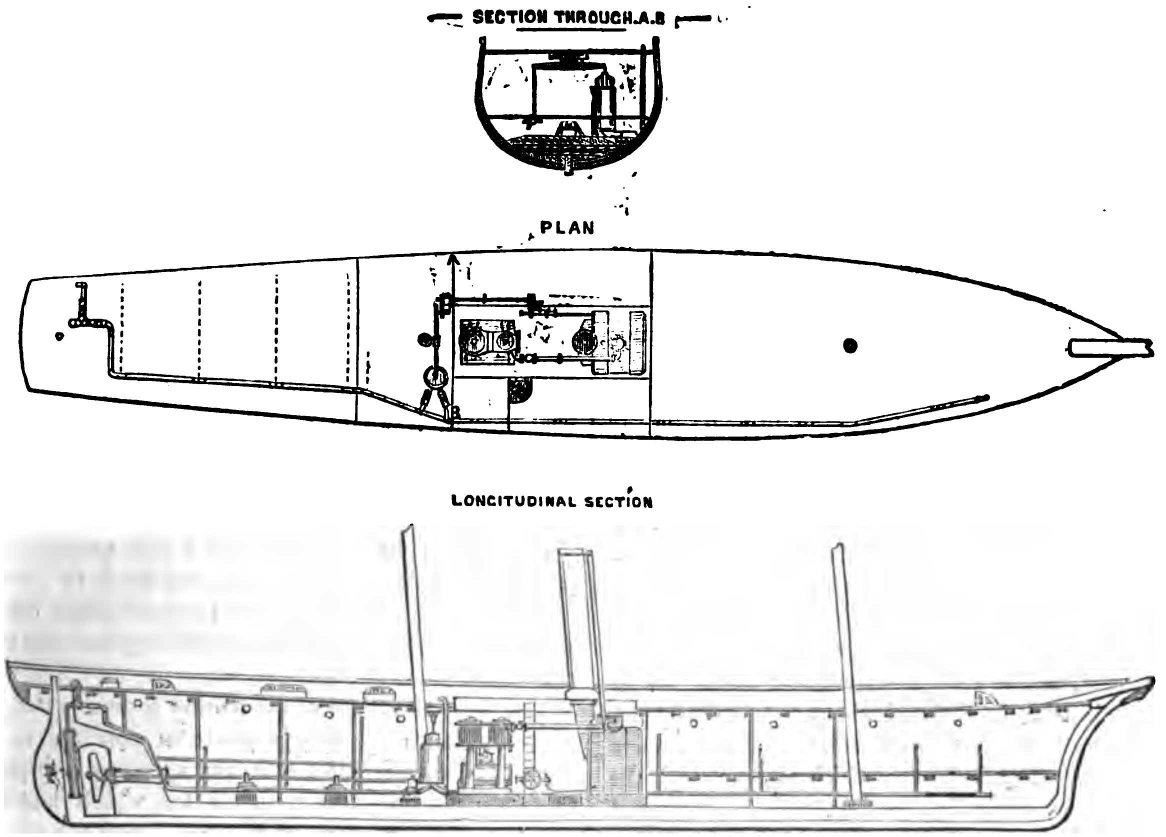


THE PATENT LIGHTNING-SPEED CHECK GOVERNOR.

attain this advanced place, and thus again disturb the equilibrium of the governor weights in the opposite direction. In order to give full effect to this action, the driving of the governor weights are caused to be transmitted through the pins *J*, instead of through the centre spindle. What is claimed by the inventors of this governor is not so much the mechanism just described, but the real invention is the combination of mechanism, consisting of curved slots and sliding pins, actuated by inertia and momentum and controlling springs, so as by these actions jointly to produce a governing movement for steam engines.

Some of the advantages claimed by the inventors of this governor are—simplicity of construction, and consequently, not easily deranged; easily adjusted when required for various speeds; sensitive action, as its name implies; being actuated direct from the engine and independent of springs.

The working parts being entirely encased are kept perfectly free from dust and dirt, and can all be oiled while in motion.



The Board of Trade S.S. "Ceylon" fitted with the NORTON AUTOMATIC AND POWER VENTILATORS, Manufactured by A. G. Mumford, of Colchester.

This Drawing is reduced to 1-4th the size of a Scale Drawing of 3-16ths inch to the foot.

THE NORTON POWER HOUSE AND SHIP VENTILATOR.

THE ventilation of ships is a subject which has been studied and experimented on by various authorities for many years past. Numerous methods for the purpose of introducing currents of fresh air to different portions of a vessel have been tried in the shape of patent cowls, shafts, and air-trunks, and where these have failed, the fan-blower has been used, driven either by air or steam to introduce currents of fresh air into double bottoms, stokeholds, and other confined portions of our modern ship. By the above methods, the sanitary condition of the most confined portions of vessels has been considerably enhanced. It has, however, been felt that something still further was required to complete our marine ventilation, as also the ventilation of extensive public buildings, mines, tunnels, &c.

By the application of the ventilating arrangement termed the Norton Ventilator, the root of the sanitary evil is reached and removed in the shape of the foul accumulations which are automatically pumped away from the various compartments, leaving a space into which fresh air will readily rush. As is usually the case, this plan seems so simple, that it is a wonder it was not thought of before. The introduction of a shaft to a compartment or a series of compartments of a vessel which are charged with more or less noxious atmosphere, does not necessarily cause the expulsion of the evil, and the introduction of fresh air; in fact, in many instances, the bulk of the bad atmosphere having no channel of egress simply stagnated the action of the fresh air in the shaft. The same remarks refer to mines, tunnels, &c. By the use of the Norton Automatic and Power Ventilators, it will be readily seen how effectively the foul air question is dealt with, and that evil entirely removed.

Figs. 1, 2 and 3 show the general arrangement of the Norton Automatic and Power Ventilators, as fitted to the Board of Trade s.s. *Ceylon*, and manufactured by A. G. Mumford, of Colchester.

The apparatus consists of a power ventilator for use in steamers, buildings, tunnels, or any enclosed place where power can be applied, while in the case of ordinary vessels, it is so constructed as to work automatically by the mere movement through the water. By order of the Board of Trade, both systems have been combined on board the *Ceylon*, with a trifling additional cost. A circular iron tank 33 in. in diameter, 4 ft. in height, and two-thirds full of water is provided, and inside this is an air-chamber or cylinder 12 in. less in diameter than the tank, with an oval top and open at the bottom. The air-chamber or bell, as it is called, is made to plunge up and down inside the tank, by the application of steam or other motive power, the water forming the packing of the pump. Connected with the bottom of the tank are two valves, one used as an exhaust and the other as a discharge valve. The first-named valve is in connection with a line of 4-inch piping which runs the entire length of the vessel, and from this there are branch pipes of 2 in., 1½ in. and 1 in. diameter leading to the coal-bunkers, bilges, state-rooms, cabins, lockers, and under the ceiling of the ship. By the operation of the air-chamber, the air is constantly exhausted from every part in which a branch pipe is fixed, and to such an extent that all the air in the vessel is entirely changed about once every hour. The importance of the result thus attained will at once be apparent. The foul gases which accumulate in the bunkers, bilges, and other enclosed spaces are carried clear away and discharged into the open air, where they become innocuous, while in the case of the cabins and all spaces between decks the atmosphere is kept perfectly pure and inodorous. The automatic ventilator is operated by the movement of the ship, and can be used at sea when the power ventilator is not required to be used. It consists of a copper pipe or piston attached to the stern post, and is 9 feet long, 15 inches in diameter fore and aft, and 5 inches in diameter crosswise, and is made to conform to the shape of the post. From this a 4-inch pipe passes into the stern of the ship, where it is attached to a pair of valves similar to those connected with the power ventilator. As the stern of the vessel rises in the sea, the water in the pipe or cylinder falls, thus creating a vacuum, to fill which the air is drawn through the same system of pipes already described. The downward movement of the stern towards the sea causes the water to rise in the cylinder, and the air which had been previously drawn in from the various parts of the vessel is forced through the discharge valve into the open air outside. It has been found from actual tests, that with a rise and fall of the ship of only one foot, the automatic ventilator exhausts no less than 5,000 cubic feet of air per hour, while the power ventilator, worked from a beam attached to the donkey engine, is capable of exhausting 38,000 cubic feet per hour.

At the trial everything connected with the apparatus was found to work most efficiently, and to more than justify the claims made for it by the inventor.

The Criterion Theatre having tried other methods of ventilation without satisfactory results, is most successfully ventilated since the adoption of this plan, as are also many large buildings and offices. Applied to ships, it will improve the sanitary condition of every sea-going vessel; and for merchant vessels carrying cattle, grain, fruit, tea, coal, or sugar, it is invaluable, as with this ventilator attached there will be no danger of cattle suffocating for want of pure air, of grain heating, tea sweating, fruit rotting, coal igniting spontaneously, or of sugar dissolving by reason of damp holds. Applied to coal vessels, it would remove all danger of explosion from coal gas, and at the same time by contributing to the purity of the atmosphere, have a very beneficial effect upon the wood and iron-work.

Properly applied to coal mines it will provide every part of the mine with pure air, and tend to prevent explosions. Tunnels, also, by its application can be kept free from smoke, and constantly supplied with fresh air.

The great advantage of the Norton system is that the apparatus in size is always made to conform to the amount of work required of it, and adjusting it to public buildings and ships, the purposes for which buildings and ships are used, and the number of persons occupying them especially considered, and the apparatus constructed and applied accordingly. The plan of the inventor is in every case to provide a certain quantity of fresh air per minute for each person occupying the premises. Hence it must be apparent that the ventilation must be positive and effective.

Of the many inventions brought forward for years past on boat-lowering apparatus and saving life at sea, few have received any lasting attention, principally on account of the fact that the mechanism was of an exceedingly complicated character, and the practical application of different inventions gave generally unsatisfactory results. Occasionally inventors have supplied a tolerably simple invention which they have had adopted by different owners, Governments, &c. We have had brought to our notice the boat-lowering and disengaging gear of "the British and Foreign Boat-Lowering Apparatus Company, Limited," of 4, Great Winchester-street Buildings, E.C. This invention from the use of a ball in the place of hooks, which are most objectionable and dangerous, combined with the facility for lowering and attaching boats under every condition, appears to be the best of the many numerous methods in existence. The Company are making rapid progress with their lowering gear, and also with their davits, having fitted a considerable number of vessels, and received the most unqualified expressions of satisfaction from all who have used them. The Peninsular and Oriental Company's s.s. *Rosetta*, and Messrs. Siemens Brothers Telegraph ship *Farady*, are amongst the latest vessels fitted with this gearing. Admiral Sir John E. Commerell, R.N., K C.B., V.C., reports very favourably on this boat-lowering apparatus, and it is highly probable that, as this is more generally adopted, it will command universal satisfaction,

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Goldcliffe.—On December 28th the Palmer Shipbuilding and Iron Company, Limited, launched from their Howden yard the iron screw-steamer *Goldcliffe*, built to the order of Messrs. D. H. Morgan & Co., Newport. She measures 250 ft. in length, by 33 ft. beam and 16½ ft. depth of hold; her dead-weight carrying capacity represents 1,850 tons. Her engines are Palmer's construction of 120-horse power nominal, the cylinders being 28 in. and 54 in. in diameter respectively, with 36 in. length of piston stroke. She is fitted with Emerson Walker & Co.'s patent windlass. The Palmer Company put into the water last year a total tonnage of over 50,000 tons.

General Roberts.—On December 28th the Palmer Shipbuilding and Iron Company, Limited, launched from their Jarrow yard the screw-steamer *General Roberts*, built to the order of Barnes, Cuthrie & Co., Cardiff. She measures 258 ft. in length, by 35 ft. beam, and 18 ft. depth of hold, and has a carrying capacity of 2,000 tons dead-weight. She is fitted with patent windlass by Emerson Walker & Co. Her engines, also constructed by the Palmer Company, are of 130-horse power nominal, the cylinders being 31 in. and 51 in. in diameter respectively, and 36 in. length of piston stroke.

Afrikaan.—On December 28th there was launched from the yard of Messrs. Raylton Dixon & Co., Middlesbrough, a steamer which was named the *Afrikaan*, for the New Afrikaan Company of Rotterdam. She is 232 ft. over all, 31 ft. 3 in. beam, 22 ft. depth of hold, and will carry 2,550 tons, having a gross tonnage of about 1,227 tons. She is built on the spar-decked rule, and has iron main deck, steam-steering gear, and accommodation for captain and first-class passengers aft. Her engines, of 100-horse power, will be supplied by Messrs. Blair & Co., of Stockton. She is intended to be employed in the trade between Rotterdam and the Congo River. On leaving the ways she was named the *Afrikaan* by Mr. Step, the inspector for her owners. This was the thirteenth vessel built last year by Messrs. R. Dixon & Co., and makes up their tonnage launched to 25,036 tons, or about one-third more than has ever been launched from this yard in one year before.

Cumbria.—On December 31st a screw steam yacht, named the *Cumbria*, was launched from the yard of Messrs. C. Mitchell & Co., on the Tyne. The yacht was built for the Earl of Lonsdale, and being intended for long cruises she will be fully rigged as a barque. She is of 615 tons, and will be fitted with engines of 100-horse power.

Inchboroa.—On December 31st there was launched by Messrs. C. Mitchell & Co. the screw steamer, *Inchboroa*, of 3,000 tons burthen, which has been built to the order of Messrs. Harrison, Fraser & Co., of Liverpool. The vessel was christened as she left the ways by Mrs. H. B. Harrison.

John Readhead.—On January 15th the first launch of the year from the yard of Messrs. John Readhead & Co., West Docks, South Shields, took place. The vessel was named the *John Readhead*. She is of the following dimensions:—Length, 255½ ft.; breadth, 34½ ft.; depth, 19 ft. 8 in. She will have a long raised quarter deck, and a bridge amidships. She will be fitted with engines constructed by Messrs. Readhead, of 155 nominal horse-power, and all the latest improvements; she will be classed 100 A 1 at Lloyd's; her deadweight carrying capacity will be 2,300 tons. She has been built to the order of Messrs. Franz Rahtkens, Olsen & Co., of Middlesbrough, and is intended for the Mediterranean trade. The ceremony of christening the ship was performed by Miss Olsen.

Bengeo.—On January 19th the Whitehaven Shipbuilding Company launched a steamer of about 1,700 tons, built to the order of Mr. Joseph Hoult, Liverpool. On leaving the ways she was christened *Bengeo* by Mrs. Handley, wife of James Handley, Esq., of Runcorn. The builders have three similar steamers in course of construction for the same owners.

Nymphæa.—On January 19th there was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), of Willington Quay, on Tyne, an iron screw steamer of the following dimensions, viz.:—Length between perpendiculars, 287 ft.; breadth, 37 ft.; and depth, 23 ft. 6 in. The vessel has been built to the order of Messrs. Joseph Robinson & Co., of North Shields, and is named the *Nymphæa*. Her engines are supplied by the North-Eastern Marine Engineering Company (Limited), of Sunderland, and are as follows:—Diameter of cylinders, 33 in. and 63 in.; length of stroke, 39 in. She is fitted with all modern appliances, including Tyzack's patent anchor.

Mastiff.—On January 19th Messrs. R. Thompson & Sons launched from their shipbuilding yard at Southwick, Sunderland, an iron screw steamer, built to the order of Messrs. R. Thomson & Co., 72, Mark-lane, London, of the following dimensions, viz.:—Length over all, 251 ft.; breadth, 35 ft.; depth of hold, 22 ft. 9 in.; having been constructed under Lloyd's special survey to class 100 A 1 for the spar-deck rule, and also under the personal superintendence of Mr. M'Hall. There is accommodation aft for captain and spare berths; the officers and engineers are amidships, and seamen and fireman forward. She has large chart-house, pilot-bridge, look-out bridge forward, and smoke-house aft, with water ballast in both holds, and is fitted with three steam winches and donkey boiler, Harfield & Co.'s patent windlass, steering gear amidships, patent screw gear aft, anchor crane, and all the latest improvements, and will have engines of 130-horse power by Messrs. H. H. Morton & Co., of Leith. On leaving the ways she was named the *Mastiff* (pro. tem.) by Mrs. R. A. Wood, of Newcastle.

Grassendale.—On January 19th an iron built sailing ship, named the *Grassendale*, was launched from the yard of Messrs. Williamson & Son, of Workington and Harrington. The ship was the first one that was launched from the Workington yard, but the forty-seventh from the yard of the same firm as far as Harrington is concerned. She is built principally for the Australian and Californian trades, and is owned by a Limited Liability Company, of which Messrs. R. W. Leyland & Company, of Liverpool, are the managing owners. From the following particulars one may judge of her capacity:—Her total length, over all, is 280 ft.; her breadth, 39 ft.; her depth of hold is 23 ft. 7 in.; and her draught, when loaded, is 21 ft. 6 in.; her gross tonnage is 1,850 tons, but she is built to carry 2,900 tons. She is classed 100 A1 at Lloyd's, the highest class; and will be in command of Captain Richardson. The first frame was erected in March, 1881, so that she has not been altogether twelve months in course of construction.

Benhope.—On January 20th Messrs. Caird & Purdie, of Barrow-in-Furness, launched a steamer of 2,000 tons for Mr. Joseph Hoult, of Liverpool, and have orders for two similar steamers for them. Miss Finlay, daughter of Edmund Finlay, Esq., of Liverpool, performed the ceremony of naming the steamer *Benhope*. These steamers will be fitted with steam steering gear and all latest improvements, and will form a valuable addition to the owner's fleet.

Frankistan.—On January 21st Messrs. Oswald, Mordaunt & Co., launched from their shipbuilding and engineering works, Southampton, an iron sailing ship, of 2,000 tons register, named the *Frankistan*, built for the British and Eastern Shipping Company, Liverpool, of the following dimensions:—Length, 270 ft.; breadth, 29 ft. 6 in.; depth of hold, 24 ft. The ship is built with full poop, monkey forecastle, and large midship house for crew. She is fitted with Harfield's patent windlass for lifting anchors, and all latest improvements, including an excellent arrangement for ventilating cargo, &c. She is intended to class 100 A 1 at Lloyd's and 20 years in the Liverpool Underwriters' Registry. The ceremony of naming the vessel was performed by Miss M'Donald, daughter of the managing owner. When the vessel is fitted out, she will be under the command of Captain Brown, who has been superintending her while building.

Matthew Bedlington.—On January 21st an iron screw steamer was launched from the Whitehall Shipbuilding-yard, Whitby, and will form an addition to Messrs. T. Turnbull & Co.'s fleet. The new steamer is 280 ft. long, 38 ft. in breadth, and 20 ft. 9 in. depth, and has a deadweight capacity of about 3,050 tons. He engines, by G. Blair & Co., of Stockton, are 180-horse power. She is classed 100A 1 at Lloyd's, and is fitted with every modern appliance and improvement. The steamer, on leaving the ways, was christened the *Matthew Bedlington* by Mrs. M. Bedlington, of Robin Hood's Bay. She will run chiefly in the Indian and American trades.

Hawarden.—On January 24th Messrs. W. Gray & Co., West Hartlepool, launched from their yard an iron screw steamer of the following dimensions:—Length, 268 ft.; breadth, 35 ft. 6 in.; depth, 19 ft. 9 in.; to class 100 A 1 at Lloyd's; to the order of Mr. T. S. Hudson, of West Hartlepool; intended for the American or Indian trade; to carry 2,500 tons. She is fitted with all recent improvements, including steam steering gear amidship, and tiller gear aft, patent windlass by Emerson & Walker, and four steam winches. The engines are fitted by Messrs. Thomas Richardson & Son, of Hartlepool, 180-horse power. On leaving the ways the christening ceremony was performed by Miss Farmer, of Seaton Carew, the vessel being named the *Hawarden*. This is the fifth vessel built by this firm for Mr. Hudson, and another is in progress.

LAUNCHES.—Scotch.

Mahinapua.—On December 31st Messrs. William Denny Brothers launched from the Leven Shipyard, Dumbarton, a steel twin-screw steamer of about 426 tons gross register for the Union Steamship Company of New Zealand, which on leaving the ways was named *Mahinapua* by Miss Janet Denny, of Helenslee, daughter of Mr. Peter Denny, senior partner of the firm. The dimensions of the vessels are:—Length between perpendiculars, 160 ft.; breadth (moulded), 26 ft. 10 in.; depth (moulded), 13 ft. 4 in. The vessel will be fitted by Messrs. Denny & Co., Dumbarton, with two pairs of compound surface-condensing engines, having cylinders 17 in. and 30 in. diameter and 24 in. stroke. The *Mahinapua* is intended for the New Zealand coasting trade, the exigencies of which had led to her construction on the twin-screw principle. She is built to the highest class at Lloyd's, and her construction has been personally superintended by J. Darling, superintendent, Union Steamship Company of New Zealand. She will be taken out and commanded by Captain Jones, of the same company.

Inversnaid.—On January 4th Messrs. Robert Steele & Co., Greenock, launched a sailing ship whose dimensions are:—Length, 240 ft.; breadth, 38 ft.; depth, 22 ft. 7 in.; tonnage, 1,559. She has been built for Mr. John M'Gregor, lately of the firm of Messrs. J. & W. Stewart, and is intended for the East India trade. As she left the ways she was named *Inversnaid.*

Wicklow.—On January 7th there was launched from the shipbuilding-yard of Messrs. Robert Steel & Co., Greenock, an iron screw steamer for the coasting trade of the Clyde Shipping Company. This vessel has been built under special survey, to class 100 A 1 in Lloyd's Register, has been constructed with a double bottom fore and aft, on the bracket system, and registers 1,020 tons gross. The following are her principal dimensions:—Length, 225 ft.; breadth of beam on spar deck, 28 ft. 9 in; on main deck, 30 ft.; between deck, 30 ft. 10 in.; and will be propelled by a pair of surface-condensing engines of 180-horse power. These engines will have two cylinders of 27 and 57-in. diameter, by 48-in. stroke, having a starting cylinder with Routledge valves, and donkey engine for working same. In addition she will have steam winches, cranes, Emerson, Walker & Co.'s patent windlass, and all other modern appliances for loading and discharging cargo with ease and despatch. The boilers, two in number, are constructed to Board of Trade requirements for a working pressure of 100 lbs. per square inch, and all the component parts of the engines have been made of strength sufficient to stand that pressure. The vessel on leaving the ways was named *Wicklow* by Miss May Brymner, daughter of Bailie Brymner, one of the partners of the firm, being thereafter towed into the Victoria Harbour, where her engines, which have been made by the builders, will be fitted in.

James A. Garfield.—On January 9th Messrs. William Hamilton & Co. launched from their shipbuilding-yard at Port Glasgow an iron screw steamer of the following dimensions, viz.:—Length, 300 ft.; breadth, 36 ft.; depth, 25 ft. 6 in. To carry upwards of 3,000 tons deadweight; horse power nominal, 250. This steamer is the first of a new line, to be called the "President Line," and has been built to the highest class at Lloyd's. She is fitted with M'Lachlan & Co.'s patent steam steering gear, steam windlass, and steam winches, as well as all the latest modern improvements for facility and economy in loading and discharging, and has accommodation for 30 first-class passengers. Her 'tween decks are specially adapted and ventilated for carrying troops, cattle, fruit, &c. She is to be commanded by Captain James O'Neill (late of the ship *G. W. Wolff*), under whose superintendence the steamer has been built. On leaving the ways the steamer was named *James A. Garfield*, by Miss Jeanie Hamilton. The vessel has been built to the order of Messrs. D. W. R. Read & Co., London, New York, Philadelphia, and Baltimore, who are the managing owners of the new line.

Bandeath.—On January 16th Messrs. Russell & Co. launched from their Port Glasgow yard a barque of the following dimensions:—Length, 180 ft.; breadth of beam, 30 ft. 6 in.; depth of hold, 18 ft. This vessel has been built for Messrs. W. and J. Lockett, Liverpool, and is the first of two vessels for this firm. She is of similar dimensions to the *Ben Lawers*, built by Messrs. Russell & Co. for Messrs. Gourlay Bros., Glasgow, several years ago. As she left the ways she was named the *Bandeath* by Miss Russell.

Garvel.—On January 18th Messrs. Blackwood & Gordon launched a new lightship for Garvel Point. The ship is 40 ft. in length, on the deck of which is a large erection, fitted up with what is called the eclipse light. There is on board a large gas tank, which will be periodically filled by the steamer *Torch* from the gasworks of the Lighthouses Trustees at Port Glasgow. The new ship has been named the *Garvel.*

Cloncaird.—On January 19th Messrs. John Reid & Co., Port Glasgow, launched a steel barque called the *Cloncaird*, for Messrs. John Kerr & Co., Greenock. The new vessel is 1,300 tons register, and 1,500 tons builders' measurement. This is the fifth vessel built by Messrs. Reid & Co. for the same firm. The *Cloncaird* will be commanded by Captain Murdoch, who has been for a long time in the employ of Messrs. Kerr & Co.

Kansas.—On January 19th Messrs. Chas. Connell & Co. launched from their ship-building yard on the Clyde, the *Kansas*, an iron full-powered screw steamer, built to the highest class both in English and French Lloyd's, and to the Board of Trade requirements, for Messrs. George Warren & Co., Liverpool. She has been built to the plans and under the superintendence of Mr. Gilbert S. Goodwin, the Company's consulting engineer, and with special reference to their service between Liverpool and Boston. Her principal dimensions are:—Length between perpendiculars, 435 ft.; breadth, 43 ft. 6 in.; depth, 35 ft.; gross tonnage, 5,300 tons. The engines, which are on the compound principle, will indicate 3,000-horse power, and will be supplied with steam from four steel boilers at a working pressure of 80 lbs. to the square inch. The steamer is fitted with four decks, three of which are iron throughout the entire length, and sheathed with wood planking. She is divided into eight water-tight compartments, and her deadweight cargo and coal capacity will be 5,700 tons. The steering and engine telegraphs are by Messrs. Chadburn & Son, Liverpool. She will also be supplied with Sir William Thomson's steering compass, and his latest improved sounding machine. The new vessel is four-masted, square rigged, with double topsail yards on the fore and main masts. All the masts are fitted with cargo derricks, spans, &c., at each hatch, and with every requirement for rapid and safe working of cargo. The *Kansas* will be commanded by Captain A. H. Burrell, the senior commander of the Warren Line. The ceremony of naming her was performed by Miss Edith Warren, daughter of the late Mr. George Warren, Liverpool.

Congo.—On January 20th Messrs. Cunliffe & Dunlop launched from Inch Works, at Port Glasgow, the screw steamship *Congo*, which they are completing as an addition to the fleet of the British and African Steam Navigation Company. The new steamer, which is entirely built of steel, is 300 ft. long by 36 ft. beam and 22 ft. depth moulded. She is classed in the highest grade of Liverpool Lloyd's, with Board of Trade passenger certificate, and is intended specially for trading between Liverpool and the West Coast of Africa. The whole of the accommodation for passengers and officers is contained in a bridge-house amidships, while the crew's quarters are in the forecastle. In all the accommodation careful attention has been paid to secure complete ventilation for the hot country service for which the new vessel is intended. Immediately after the launch the *Congo* was berthed alongside of the builders' wharf, where the engines will be fitted on board, and the vessel completed ready for sea. The ceremony of naming the new steamer was performed by Miss Kate Wilson, of Glasgow.

M'Allister.—On January 21st Messrs. Blackwood & Gordon launched from their shipbuilding-yard, Port Glasgow, an iron screw steamer of the following dimensions:—200 by 30 by 15, about 1,000 tons, built to the order of Mr. E. M'Allister, for his firm, M'Allister & Co., Singapore. She is to be commanded by Captain J. M. Tullock, R.N.R. As the vessel left the ways she was named the *M'Allister* by Miss Alice Edmonstone, youngest daughter of Admiral Sir William Edmonstone, Bart., of Duntreath Castle. This vessel will be furnished by her builders with compound surface-condensing engines of 110-horse power, and fitted up with extensive saloons, well ventilated. She will form an addition to the M'Allister line of Eastern traders.

Stirling Castle.—On January 21st the screw steamship *Stirling Castle*, of Messrs. Thomas Skinner & Co.'s London and China Line, was launched by her builders, Messrs. John Elder & Co., of Fairfield, Govan, Glasgow, the ceremony of naming the vessel having been performed by Miss Reed, of South Kensington. This fine steamer is 436 ft. in length, 50 ft. beam, 33 ft. in depth, and registers about 4.500 tons gross, and will be fitted by her builders with a set of engines of their well-known three-cylinder type to indicate 7,000-horse power. These engines are constructed to propel the vessel at the rate of 18 knots, so that she is expected to carry the first teas from China to London in the unprecedented short period of four weeks, or perhaps, a little less. Her passenger accommodation is well ventilated, and will be fitted up with every regard to health and comfort, while her appliances for rapid loading and discharging of cargo are unsurpassed. She is to leave the Clyde to load at London for China the last week of February. Immediately after the launch the vessel was towed into the basin at Messrs. J. Elder & Co.'s works to receive on board the boilers and machinery, which are all in readiness at the shears to go on board.

Rover.—On January 21st there was launched from Messrs. Ramage & Ferguson's shipbuilding-yard, at Leith, a new iron auxiliary steam yacht for the Earl of Eglinton. The vessel, which on leaving the ways, was named the *Rover* by Mrs. St. Clare Byrne, of Liverpool, presents many novel features in yacht construction, and will, no doubt, attract much attention during the coming season. The dimensions are:—Length, 175 ft.; breadth, 27 ft. 6 in.; depth moulded, 17 ft.; tonnage, 650; horse-power, 85 nominal; cylinders, 23 and 44 inches diameter by 24 inches stroke. The *Rover* has been built to the design and under the superintendence of Mr. St. Clare Byrne, of Liverpool, and, when finished, will likely start for a Mediterranean cruise.

LAUNCH.—IRISH.

Garfield.—On January 7th a sailing vessel, of very handsome model, named *Garfield*, was launched by Messrs. Harland & Wolff for Messrs. Ismay, Imrie, & Co., of the White Star Line, Liverpool. The *Garfield*, which is built of Siemens-Martin steel, has a full poop, is fitted with cabins for officers, and has a deck house for the accommodation of the crew; a steam winch and boiler, driving winch, and iron masts, with all the other latest improvements, will also form part of the fittings. The newly-launched vessel, which will be completely rigged by the builders, is of the following dimensions:—Length, 292 ft.; breadth, 41 ft. Gross register tonnage, about 2,300; and she has been classed 100 A 1 at Lloyd's. Shortly after the launch, which was accomplished most successfully, the *Garfield* was towed to the crane at the Abercorn Basin for the purpose of having her masts and other equipments put on board—a work which, it is expected, will be accomplished in about a month.

LAUNCH.—FRENCH.

La Ville de Pernambuco.—On January 10th was launched from the shipbuilding yard of Forges et Chantiers, de la Mediterranée, at La Seyne, near Toulon, an iron screw steamer, built for the Compagnie des Chargeurs réunis du Havre. Length between perpendiculars, 294 ft.; breadth, moulded, 35 ft.; depth, moulded, 25 ft.; tonnage, net registered, 1,400 tons. She will carry about 3,000 tons, and is classed at the highest class of Bureau Veritas, under special survey. She will be provided with direct-acting compound engines of 1,000 indicated horse power by the same firm at Havre. Cylinders 34 and 64, with 40 in. stroke. Steam will be supplied from two large cylindrical boilers, with large heating surface, and of superior construction, for a working pressure of 80 lbs. The steamer is to be brig-rigged and spar-decked. She will be fitted with double bottom for water ballast, four steam winches, and all the most recent and improved appliances for expeditious loading and discharging cargoes, patent windlass, and patent steam steering gear. In addition to superior cargo space for the conveyance of general goods. the vessel will be able to accommodate in 'tween decks 30 passengers, with the dining saloon on upper deck and a promenade deck on top. She is fitted as well to accommodate a great number of emigrants. The captain and officers are accommodated in houses amidships. The steamer was christened *La Ville de Pernambuco* as she left the ways. She will form the fifth of a fleet of fine screw steamers ordered by the same firm at Havre.

LAUNCH.—SWEDISH.

Saltholmen.—On January 18th there was launched from the yard of the Motala Company at Lindholmen, a screw passenger steamer, sister ship to the *Hoen*, launched in December last, and built for the same owners, "Det forenede Dampskib Selskab," in Copenhagen. This steamer is of the following dimensions:—Length, 148 ft.; breadth, moulded, 23 ft.; depth of hold from top of keel, 10 ft.; height between decks, 7 ft. 3 in. *Saltholmen* is a very strong-built vessel, the frames being 27 in. apart, with an extra frame in each space, running from keel to above the load line. The hull plating is of extra thickness throughout the whole ship. She will receive engines of 100 nominal horse power.

TRIAL TRIPS.

Sorrento.—On December 31st this screw steamer, built and engined by Messrs. Alex. Stephens & Sons, Linthouse, Govan, to the order of Messrs. R. Sloman & Co., of Hamburg, made her trial trip, and underwent a speed test at the measured mile off Skelmorlie. Six progressive trials were made, the mean maximum speed being 11¾ knots.

Torch. — On December 31st the twin-screw steamer *Torch*, built by Messrs. Robert Duncan & Co., Port Glasgow, for the Clyde Lighthouse Trustees, to be used in connection with their gas works at Port Glasgow and the gas-lit buoys on the Firth, went on her trial trip. The *Torch* ran the measured mile twice, attaining an average speed of about 11 knots, a rate which was considered entirely satisfactory. Thereafter the steamer proceeded to Toward Point, the company on board disembarking and making an inspection of the lighthouse and its appurtenances.

Hindoustan.—On January 6th the screw steamer *Hindoustan* had a very successful trial trip. She has been built to the order of the Maurice & Reunion Company, Marseilles. Her length over all is 322 ft.; breadth, 40 ft.; and depth of hold, 29 ft. 5 in; her carrying capacity, deadweight, being 3,700 tons. The vessel is fitted with Palmer's engines of 300-horse power nominal; the cylinders are respectively 38 in. and 71 in., and the stroke of the piston 48 in. She will take the highest class at Lloyd's. The vessel has extra scantlings, main deck of chequered iron plates, water ballast upon the cellular principle fore and aft, awning deck, Emmerson & Walker's patent steam combination windlass, four steam winches, Bow, Maclachan, & Co.'s patent steam steering gear, and all other modern improvements. Amidships she has a long bridge-house, covering the engine and boiler space, and containing accommodation for the officers and engineers, and she has also first class cabin accommodation.

Virginian.—On January 6th the Atlantic liner, the *Virginian* (s), built and engined by the Palmer Shipbuilding and Iron Company (Limited), at Jarrow, for Messrs. F. Leyland & Co., of Liverpool, was taken out for a trial trip. This vessel has been specially built and designed to meet the increasing requirements of the carrying trade between this country and America, and forms the latest addition made to the liners under the management of Messrs. Leyland & Co. between the Mersey and Boston. The *Virginian* is 435 feet in length over all, by 41 feet breadth of beam, and 29 feet 6 inches depth of hold. She is classed 100 A 1 at Lloyd's, but her scantling is considerably in excess of the requirements of the registry. She has three iron decks, all fore and aft, the upper ⅝ths of an inch in thickness, with edges double, and butts treble rivetted fore-and-aft, and sheathed with pitch pine. Additional care has been taken to give great strength to the bottom of the hull by increased depth of floor plates, and by extra keelsons at the bottom bilges and sides, which are all connected to the shell plating fore-and-aft. The shell plating is of more than ordinary thickness. The weight of each boiler is 80 tons. Seven strong transverse iron bulkheads divide the hull into eight water-tight compartments, and, by way of protection from the Atlantic sea, she has a long turtle backed forecastle, in which is provided comfortable accommodation for the crew and cattle men. Amidships is erected a long iron deckhouse to cover in the saloon and the cabins provided for the use of the captain, officers, and first and second-class passengers; a hood aft, covering the store room and wheel-house, containing Hainson's patent steam steering gear, which will be worked from the wheel-house amidships by means of steel rods and bevel gearing carried aft underneath the upper deck. By way of adding to the sailing powers of the steamer, and as a safeguard to mishap through injury to the machinery, she is provided with four iron pole masts, so that she will be able to carry a large body of canvas. There are sixteen winches on the upper deck, one to each hold; and Emerson & Walker's patent direct acting steam windlass on the forecastle. Excellent provision is made for the easy shipment and discharge of cargo. Provision is also made upon the main and upper decks for the carrying of cattle from America, accommodation being provided for 700 head of cattle. In addition to the live cattle in the vast holds, there is space for stowing upwards of 4,000 tons of general cargo. According to agreement the trial trip was to be a thoroughly trying and efficient run to sea of not less than twelve hours under steam.

She left Smith's Buoys a little before three o'clock in the morning, and shortly after getting out to sea the wind, which had been blowing almost a gale from the westward during the night, rose in strength until it reached a perfect hurricane, at which it continued to blow all day, yet, notwithstanding she was even in light trim for an ordinary trial run of short duration in fine weather, her sea-going qualities,steadiness, &c., were such as to give the utmost satisfaction to all concerned. The run extended to several miles eastward, then northwards nearly to the Farne Islands, and home again to the Tyne, during which the engines yielded even greater results than were anticipated from them.

Sylvia.—On January 10th the *Sylvia*, 4, double-screw surveying vessel, 887 tons, 649-horse power, went out from Sheerness for a six hours' trial of her engines and machinery. She was accompanied by the tug *Sampson*, the precaution of sending her being taken in order that the *Sylvia* might have assistance in the case of any emergency. When near the Red Sand, about twenty miles from Sheerness, the *Sylvia* ran aground. Fortunately the tide was flowing at the time, and after being on the sands for some time she was got off without much difficulty. The trial trip altogether was of a very unsatisfactory nature, the engines priming very much. The *Sylvia* returned to the harbour the same evening, but it is not yet known whether her keel has sustained any damage. The officials of the Medway Steam Reserve were in charge of the ship at the time of the occurrence. Upon the arrival of the *Sylvia* in Sheerness harbour on Tuesday night, a party of fitters were at once sent off to remedy the defects discovered in the machinery during her trial, and to take steps to prevent the priming of the engines. The *Sylvia* was taken out for another trial on Wednesday, which was of a more satisfactory character. She will be taken into dock to have her keel examined, in order to ascertain what damage has been done by her running aground upon the Red Sand.

Jacob Christensen (s.).—This steamer, which has been built by Messrs. Raylton Dixon, & Co., Middlesbrough, to the order of Hans Konow & Co., of Copenhagen, proceeded on her trial trip lately. She is an iron screw steamer, 269 ft. long, 34 ft. 9 in. beam, and 24 ft. 3 in. depth of hold, which gives her a carrying capacity of 2,500 tons on 22 ft. draught. She is built as a three-decked steamer, having main deck of iron and upper of wood. Her water ballast is contained in a large chamber in the main hold, forward of engine room, which is also available for stowage of cargo. She is fitted with a short poop aft, in which are commodious cabins for captain, officers, and two or three passengers. Higginson's steam quartermaster steers her from the bridge, and she is fitted with steam winches and self-reefing topsails. Her engines, of 150-horse power nominal, are by Messrs. T. Richardson & Son, of Hartlepool, and gave every satisfaction on her trial trip.

North Cambria.—On January 21st the new screw steamer *North Cambria*, built at the Howdon yard of Palmer's Shipbuilding and Iron Company (Limited), to the order of Messrs. Hugh Roberts & Son, Newcastle, proceeded from Shields to sea on her trial trip. The dimensions of this vessel are:—Length between perpendiculars, 270 ft.; breadth moulded, 36 ft.; she is depth-moulded 25 ft.; and classed 100 A 1 at Lloyd's. She is intended for the general carrying trade, and has all the requisites for quick loading and the despatch of cargo. She will also carry cattle in the 'tween decks and on the main deck. Her 'tween deck is of iron. She has four steam winches, Emerson & Walker's patent steam windlass, and she is fitted with Messrs. Clarke, Chapman & Gurney's steam steering gear. The engines are fitted with Durham's improved velometer. She has water ballast fore and aft on the cellular principle. Her engines, constructed by Palmer's Company, are of 180-horse power nominal. The *North Cambria* will be commanded by Captain Wm. Evans; she has a speed of 11 knots per hour, and has proceeded to Middlesbrough to load a cargo of iron rails for Galveston.

Orion (s.).—The new screw steamer *Orion*, built by Messrs. Caird & Co., Greenock, for the Austro-Hungarian Lloyd's Steam Navigation Company, proceeded down the Clyde on Wednesday on her trial trip. The *Orion* has been built for the Eastern trade, and is to sail from Trieste. She is a vessel of 2,800 tons, with engines of 2,400-horse power, and, although she has been fitted up more for cargo-carrying purposes, she has accommodation for passengers. There are three decks, the saloon being on the upper, while the cabins are ranged on the under deck. For the purposes of loading and steering all the latest improvements in machinery have been introduced, and the vessel is fully expected to prove a credit to her builders. On board the steamer at the trial trip there were a number of gentlemen who joined her at the Tail of the Bank, which she left for the run down the Firth shortly after 11 o'clock in the forenoon. The engines worked very smoothly during the run. Arrived off Skelmorlie the *Orion* ran the measured mile three times, the speed attained being 13¾ knots, which was considered most satisfactory, the speed contracted for being 12 knots. The engines indicated 2,500-horse power, the revolutions per minute being 65. The steamer, which has been built to the highest class at Lloyd's, gave every satisfaction to all concerned during the trip.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

SEA-GOING ENGINEERS' ASSOCIATION.

To the Editor of THE MARINE ENGINEER.

SIR,—I can scarcely doubt that the following reflections would occupy the mind of every reader of "Landsman's" contribution to the correspondence columns of the October part of THE MARINE ENGINEER. An impertinence that is void of the least pretension to either wit or sarcasm can scarcely be too severely reprehended. Doubtless "Wave" would consider that "Landsman's" sole object in communicating the little information that is contained in his letter was simply that of indulging in a little spiteful growling, and it may be assumed that "Wave" will be grateful accordingly. Beyond the impertinent style of "Landsman's" letter, it contains nothing that entitles it to reply or consideration, since no one would infer from its contents that its writer was a person at all troubled with ideas, or possessed of an intelligence sufficiently keen and clear to enable him to judge of either the necessity, or the acquisition, of improvement in the case of "Sea-going Engineers;" indeed, it may be readily imagined how difficult, shall I say *impossible*, it would be for any solicitor to enrich the mind of "Landsman" with the ideas which he mouths so unnecessarily.

In conclusion, a word of advice may not be amiss to "Landsman," and we should advise that before he again commits himself to print he should take a trip to sea, when he would be relieved by a legitimate discharge of his bile, and probably, when this was accomplished, his head would be all the clearer, and he would be enabled to exercise sufficient judgment to write, at least, a courteous letter.

I remain, Sir, Yours respectfully,
A HULL "SEA-GOING ENGINEER."

CARPENTERS AND SHIPWRIGHTS IN H.M. ROYAL NAVY.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—Having read the article which appeared in your issue of last month on the Position and Status of our Royal Marine Engineers and Engine-room Artificers, which is to be followed up, I consider an account of the origin, development and requirements of any class such as you are giving most interesting to those who wish to consider the claims at different times set forth by various branches. By the descriptive account you are giving of the Marine Engineers, &c., one can form a clear opinion as to whether they receive the position to which they are entitled or otherwise.

I should like to call your attention to another branch of industry in H. M. Service that should receive immediate consideration. The branch I refer to is the carpenters, carpenters' mates, and shipwrights engaged in H. M. Royal Navy.

It is a fact which cannot be denied that the officers and highly skilled artizans mentioned are, as regards pay and recognition, the worst off in the Service. A carpenter in charge of one of our large ironclads has an amount of responsibility thrown upon his shoulders, which only many years of experience and study can fit him to undertake, and the carpenters' mates and shipwrights must serve an apprenticeship of seven years, and pass a strict examination as skilled artizans and as being well up in all the practical requirements to meet emergencies in any part of the ship.

For a long time past the Government has experienced great difficulty in obtaining properly qualified men to fill these posts. About twenty years ago Government shipwright apprentices were induced to complete the last two years of their apprenticeship on board a man of war, in the hope that many would remain in the Service, and thus improve the class of carpenter in the Navy. This however, failed, as these young fellows would not throw themselves away for the paltry pay then given, especially as they were expected to commence their career as ordinary blue jackets. These Government apprentices, it must be known, passed similar examinations to the engineer students to obtain their first entry in the Service, and continued a course of study in higher subjects during their apprenticeship.

Many of them could design, lay off, make calculation, working drawings, and order material for all classes of vessels.

Since the failure of inducing their own apprentices to join H.M. Service, the Government has instituted schools of instruction for the present carpenters of the Navy, at the different Government yards for the purpose of educating them up to their requirements. If the Government would only give such men as they want, the pay and position their services and knowledge should command, they would soon get plenty of men who would require no educating after joining the Service; and remove what is now a great drawback to that branch of the Service.

I am, Dear Sir,
A LATE GOVERNMENT APPRENTICE WHO TRIED THE SEA.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—If you would kindly answer the following question in the February number of your valuable paper, I would deem it a great favour. Suppose a steamer being towed or sailing with propeller shaft being disconnected, whether the propeller would have a tendency to go ahead or astern? Trusting you will not deem me too troublesome, and waiting the favour of an early reply,

I am, Dear Sir, respectfully yours,
Liverpool, January 25th, 1882. G. A. R.

[In the case of a ship sailing or being towed with her screw disconnected, the screw would revolve in the same direction as it would in propelling the vessel ahead.—ED. M.E.]

NAVAL AND SUBMARINE ENGINEERING EXHIBITION.

THE large hall at Islington, so noted for the many famous Exhibitions of native progress in nearly every imaginable industry, which one after the other occupy its vast area, will shortly be devoted to the Exhibition of various branches of Naval and Submarine Engineering.

It is a matter of surprise to think that as so many different exhibitions of every kind of manufacture and invention are continually taking place throughout the country, nothing of the kind affecting Submarine Engineering has for many years been undertaken on a scale which would attract special attention. Taking into consideration the vast amount of vested interest and capital engaged in all kinds of Naval and Submarine Engineering in our kingdom, and the high position our manufacturers hold in this special work, it is certain that the forthcoming Exhibition, though novel in its character, cannot but be most successful. The Agricultural Hall will be open to the public from 10 a.m. to 10 p.m. from the 10th to the 20th of April inclusive (Sunday, 16th, excepted), when, from the large number of spaces now taken, visitors will doubtless find the ground floor and galleries completely filled with inventions and appliances, each and all of a highly interesting and novel character.

Mr. Samson Barnett, jun., the originator and manager of this Exhibition, has spared no time, trouble, or expense, to assure the success which apparently awaits the result of this Exhibition. The large list of able and distinguished patrons would form a good guarantee of its value and probable ultimate success. This list contains the names of Earl Ravensworth, President of the Institution of Naval Architects; Lord Alfred Paget; Admiral Sir W. Houston Steward, K.C.B.; Vice-Admiral Henry Boys; Vice-Admiral Arthur W. A. Hood, C.B.; Vice-Admiral Sir J. E. Commerell, V.G., K.C.B.; Rear-Admiral T. Brandredth, A.D.C.; Rear-Admiral F. A. Herbert, Director of Naval Ordnance; Sir Digby Murray, Bart; Sir E. J. Reed, K.C.B., F.R.S., M.P.; Lieut.-Col. Sir William Palliser, C.B., M.P.; Sir Joseph William Bazalgette, C.E., C.B.; Sir W. Thomson, F.R.S.; N. Barnaby, Esq., C.B., Director of Naval Construction; B. Waymouth, Esq., Secretary, Lloyd's Registry of British and Foreign Shipping; J. Abernethy, Esq., C.E., F.R.S.E., President of the Institution of Civil Engineers; J. T. Smith, Esq., C.E., President of the Iron and Steel Institute; C. Horsley, Esq., C.E., F.G.S., F.M.S., President of the Society of Engineers; J. C. Foster, Esq., F.R.S., President of the Society of Telegraph Engineers; A. T. Walmisley, Esq., C.E., President of the Civil and Mechanical Engineers' Society, and Messrs. Maudslay, Son & Field.

It is to be regretted that the International Exhibition of the Worshipful Company of Shipwrights, to be held at the Fishmongers' Hall in May next is not amalgamated with the Naval and Submarine Exhibition. Had this been done, popular attention would have doubly concentrated itself on the combined exhibitions, and each one would have assisted to render the other more attractive. The Worshipful Company of Shipwrights' International Competitive Exhibition of Ship Models and Designs was instituted with the object of obtaining by competition the best design, from all points of view, of different classes of men-of-war, merchant vessels, torpedo boats, yachts, &c., all of specified types, whilst the Naval and Submarine Exhibition embraces sundry mechanical appliances of ingenious device and construction for all kinds of vessels as well as submarine plant and appurtenances for constructing docks, piers, bridges, and other work incidental to Naval Engineering. One of the greatest troubles to the promoters of the former Exhibition of the Shipwrights' Company of 1877 was the miscellaneous section of their exhibits, which did not come under any special type of ship. All branches of this kind would class in the category of the Submarine Exhibition, and some special models and drawings of high-class vessels might be sent to this Exhibition, which would have complied with some class conditions set forth by the Worshipful Company of Shipwrights. Thus both Exhibitions might have been of the greatest use to each other, and visitors to London could have witnessed both in one journey. As the fixtures now stand, one exhibition to take place in April, and the other in May next, intending visitors to each must make two journeys, or a prolonged stay in London.

The exhibitors of the Naval and Submarine Exhibition, at this premature date, are so numerous and so well known in their profession that the success of this Exhibition is completely ensured. The names of some of the exhibitors and their exhibits are as follows:—

The Admiralty: Models of six different types of men-of-war; B. Waymouth, secretary of Lloyd's Registry of British and Foreign Shipping, model of s.s. *Ostrel*, of the Peninsular and Oriental Co.; Messrs. J. Elder, of Fairfield, Glasgow; W. Denny, Esq., of Dumbarton, and Oswald, Mordaunt & Co., of Southampton, models of various vessels of interest. Sir W. Armstrong, models of the Greek alphabetical gunboats; the Inman Line, models of the *City of Rome* and *City of Berlin*; Messrs. J. and G. Thompson, of Clyde Bank Foundry, Glasgow, models of the *Servia*, and other vessels; Messrs. Palmer & Co., of Jarrow, model of large cargo-carrying steamer and *Medina* class of gunboats built for the Admiralty.

Boat-lowering apparatus, life rafts, buoys, disconnecting deck seats, cabins, &c., occupy a large space, and are generally of the most useful and interesting nature. Different kinds of screw propellers and rudders are largely represented. Amongst the exhibitors of wire rope may be noticed the names of J. E. Wright, of Birmingham; Messrs. Felton & Guillaime, near Cologne; the Warrington Wire Rope Co.; Messrs. Binks, Bros.; and Messrs. Bullivant & Co., of 72, Mark-lane, E.C., and Millwall, E. The last-named firm, Messrs. Bullivant & Co., besides samples of their exceedingly light, strong, and highly flexible steel wire ropes and cables, exhibit also their winding reels or winches, patent nippers, torpedo nets, floating anchor, and lifting barge. Under the heading of novelties may be noticed the boat built by Peter the Great during the time he lodged at Sayes Court, adjoining the Royal Dockyard, Deptford, and the First Navy List; a boat 9 ft. in length, which will be kept running in the large tank by means of liquid fuel; a 1,000-horse power rotary marine engine by Brossard, of Swansea; and drawings and models of a marine surface-condensing engine, worked for fifty years successively by the superintendent marine engineer of the Netherlands.

Refrigerating and condensing apparatus are numerously represented, as also are nautical instruments, diving apparatus, steam, hydraulic, and hand steering gear and anti-fouling compositions.

Many models of well-known sailing yachts will be exhibited; also a full-sized steam launch, with machinery by Messrs. Forrest.

The Kirkstall Forge Co.; the Leeds Forge Co.; Messrs. Hall, of Dartford; Messrs. Tangye; Messrs. Fielding & Platt; Messrs. Siebe & Gorman; and Messrs. Stone, of Deptford, with many other exhibitors too numerous to name, make up a list of names of the best known manufacturers.

Viewing the present prospects of the Exhibition, it may well be considered in a highly satisfactory state. It only remains to be proved whether our naval manufacture will attract as large an amount of attention as other branches of engineering industry; if so, and it is impossible to understand why such should not be the case, the Naval and Submarine Exhibition of April, 1882, should be a great success from every point of view.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 20th December, 1881, to 20th January, 1882.

5537 T. Nordenfelt. Breech loading guns.
5538 T. Nordenfelt. Breech loading fire-arms.
5548 H. Goebel & J. W. Kulenkamf (communicated by L. Groth). Vacuum pumps.
5553 J. H. Chapman & R. H. Harper. Packing.
5558 J. Dickinson. Crank shafts.
5561 E. Lair. Steam boilers.
5563 G. E. Palmer & A. Worthington (communicated by W. Wise). Steam generators.
5564 W. Stringfellow. Revolving firearms.
5568 J. Dickson. Steam boilers.
5570 G. B. Massey (communicated by A. Clark). Compound engines.
5571 C. T. Meyer & V. E. Meyer (communicated by A. Clark). Floor coverings.
5572 N. Weiderer (communicated by E. Brydges). Supports for locking glasses.
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5590 L. C. Norton (communicated by H. Lake). Door checks.
5595 W. C. Lockwood (communicated by A. Lake). Calls for telephones.
5599 W. Smith. Insulated conductors.
5603 O. Trossin. Consumption of smoke.
5609 C. Napier & J. Paterson. Preventing radiation.
5612 F. M. Duncon. Revolving buoy.
5615 J. N. Culbertson. Cables.
5619 C. R. Mitchell. Net hauling winches.
5625 J. T. Coleman. Cooling air.
5627 G. W. Foster & F. B. Wilson (communicated by H. J. Haddan). Electric calls.
5629 W. H. Power (communicated by E. J. Power). Shifting grain. &c., in holds of vessels.
5637 R. J. Smith. Controlling marine engines.
5647 G. A. Cochrane (communicated by W. P. Thompson). Steam ships.
5637 I. Eskriett & C. Eskriett. Fishing vessels.
5666 A. Burdess. Propelling small boats.
5672 R. Evans. Ship compasses.
5675 W. M. Bullivant. Floating anchors.
5679 J. Gillingham. Stoves.
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Anderson, J. M.	2 C	Dundee.
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Birchall, Arthur	2 C	Sndrlnd.
Blackburn, Geo. Henry	1 C	London.
Boustead, Thos.	2 C	London.
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Burdon, William	1 C	N Shlds.
Burke, Charles	2 C	London.
Cooper, Wm. T.	2 C	Glasgow.
Connell, Wm. S.	1 C	London.
Curr, Alex. G.	1 C	Dundee.
Daines, Thos. A.	2 C	London.
Davidson, James	2 C	N Shlds.
Diack, James ...	2 C	do
Dickson, Wm...	2 C	Lvrpool.
Doblyn, Samuel	2 C	N Shlds.
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Murphy, Edwd.	2 C	Lvrpool.
McKinnon, Archibald ...	2 C	Glasgow.
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Ransom, John	2 C	N Shlds.
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January 7th, 1882.

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January 14th, 1882.

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Hamilton, M. Thomas ...	1 C	Belfast.
London, David	2 C	Leith.
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McAuly, Chas.	2 C	Belfast.
Marshall, Geo. T.	2 C	N Shlds.
McMillan, John	1 C	Glasgow.
McMillan, Archibald	2 C	do.
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Smibert, John...	2 C	do.
Smith, David ...	2 C	N Shlds.
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Watt, James ...	2 C	Glasgow.

January 21st, 1882.

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Davies, Thos. P.	2 C	Lvrpool.
Edwards, Wm. G.	2 C	London.
Farman, Chas. A.	1 C	Lvrpool.
Fisher, Colin ...	1 C	do.
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Van der Luft Sven, A. ...	2 C	Hull.
Wills Charles...	2 C	Lvrpool.
Walker, John ...	2 C	do.

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SUBSCRIPTIONS.

The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, MARCH 1, 1882.

EDITORIAL NOTES.

THE Americans are never satisfied until they have produced whatever they take in hand on a gigantic scale. They are now perfecting the construction and increasing the size of their well-known paddle river boats, and are applying them for passenger and freight traffic on the outer rounds of the coast about Long Island and New York. One of the last iron steamers, built for this purpose by the Harlan and Hollingsworth Company, Wilmington, Del., has a registered tonnage of 2,485 tons, and is thus the largest vessel of her class afloat. She is called the *City of Worcester*, and is 340 feet over all, with hull beam of 46 feet, but with a breadth of 80 feet over the guards, the depth of hold being 16·3 feet. She has three stories, or tiers, of state-rooms on the forward deck, and two on the afterdeck, with a hurricane deck as promenade above. The arrangements for the safety of the passengers and crew are very complete. Besides the plentiful supply of lifeboats we are glad to see that no less than four life rafts besides many life buoys form a part of her equipment. Every berth is provided with Kaukweiler's never-sink cork life jackets, and these are also plentifully distributed to the deck passengers and crew, amounting in all to the number of 800. Every precaution has also been taken against fire. There are nine fire plug outlets on the main deck, eight in the saloon, four in the hold, and four on the hurricane deck, all supplied from two large pumps driven by a donkey engine. In the matter of lighting, too, this vessel will take an advanced position. She is specially laid out for electric lighting with 100 Edison lamps. A 20-horse power engine is especially provided to drive the generator for these lamps. She is also governed by steam steering apparatus, operated in the pilot house. The fittings and joiners work, as may be imagined, are exquisite, and the whole vessel is really a triumph of naval architecture and engineering skill.

THERE seems to be somewhat of a mania for constructing tunnels under water ways, channels, and rivers. In addition to the projected Channel Tunnel of which so much is now heard, the Hudson River tunnel, is an undertaking of no small difficulty and magnitude; and we hear that a new tunnel was just being decided on under the St, Lawrence River at Montreal, Canada. The contract has just been taken by J. B. Bouilliard for 3,500,000 dollars, the work to be finished in 1885. Permission has also been granted by the Italian Government to the Venetian Society of Construction, to make the necessary preliminary investigations for a tunnel under the Straits of Messina between Italy and Sicily. The rock to be traversed is extremely hard, and a stratum of 120 feet of rock will be left between the top of the tunnel and the sea. The approaches to the tunnel at either end are to be made by spiral tunnels.

TORPEDO boats will soon form a most important item in the naval armament of all maritime powers. A great deal of ingenuity will, however, be required in their construction before they can enter the lists against ironclads with any chance of success. At present, in a dark night they are, when unexpected, a dangerous foe; but if rendered conspicuous by daylight or the electric light, they are exceedingly vulnerable. A few well-directed bullets below or about water-line from the Nordenfelt or Hotchkiss gun will suffice to admit the water, and thus rapidly to disable the boat—as a rule, a few inches of water in the stokehole will suffice to put out the fires. We understand that some torpedo boats have already been made for the Italian Government in which a special arrangement is fitted by Messrs. Yarrow, so that the sudden admission of water to the hold or stokehole of the boat shall be prevented from entering the fire-box and extinguishing the fire. A boat with the new fitting would be able to retain its steaming power for five honrs, even after the stokehole had been flooded, and thus ample time for escape would be given. It is rather odd, and somewhat discreditable to the Admiralty, that Foreign Governments should always thus obtain the benefit of English private ingenuity before our own. We think that the adaptation of such a fitting to the furnaces of all steamers would be most valuable as a protection against the disabling effect of sudden swamping.

AN American so-called accelerating gun is attracting a good deal of attention on the other side of the Atlantic. It is well known that the action of gunpowder by explosion is very sudden in its action upon the projectile, and confined in its operative effects almost entirely to the breach of the gun. That is to say, the expansive force of the gunpowder almost entirely falls off before the shot has travelled through a small portion of the barrel. This is shown by the excessive strength which it is thus necessary to give to the breech of our large guns and the comparative slightness of the other part of the barrel. Sudden and explosive action upon a shot is far from being a good method of producing a high velocity. Speed can only be acquired by a heavy body gradually, and after the movement through an appreciable distance. The accelerating gun referred to endeavours to realise these views by spreading the effect of a succession of charges over a considerable length of barrel. The bore is provided with a series of pockets, each containing a separate charge of gunpowder, which are ignited successively as the shot passes. The shot is thus put gradually into motion, and each successive charge keeps up a constant accelerating pressure throughout the whole travel of the shot in the gun. The result is, that the maximum pressure in the breech is very much reduced as compared with the present system, whilst the final velocity is very much accelerated. Guns on this system can be built at about half the weight for equal penetration, compared with those of the present system.

THE Royal Naval Engineers are again endeavouring to draw attention to the very obvious injustice of their position, by means of a pamphlet, which very clearly and temperately sets forth the grievances under which they suffer. It is difficult to imagine any reasonable ground why the naval engineers should be placed in a worse position as to increase of pay now than was their case some twenty years ago. The mechanical appliances on board our ironclads are increasing in number and importance from year to year, and the success, or otherwise, of any naval engagement would depend more than ever upon the successful operation of the mechanical appliances, and consequently upon the skill and readiness of the engineers in charge. It is truly "hard lines" that, after seventeen years' service the pay is only 11s. per day, instead of 13s. as in 1863, and after twenty-six years only 14s. to 16s., instead of 18s. as formerly. Apart from these substantial grievances, those more sentimental ones of rank and relative position as to the other naval officers will be not the less galling to the feelings of those gentlemen who compose the engineer department. It will be impossible much longer to refuse the proper social and monetary recognition to that branch of the naval service, which is now certainly most necessary. We can imagine an engineer officer fighting an ironclad in the case of the disablement of the naval officers, but we cannot imagine the engines being worked or rapidly repaired by the naval officers in the absence of the engineers.

THE PROPOSED NEW LINE OF ATLANTIC STEAMERS.—A Bill was introduced in Congress on February 8th, authorising the Postmaster-General to contract for and establish a weekly mail steamship service between Fort Pond Bay, Long Island, and Milford Haven, by means of a line of iron and steel screw steamers, capable of making at least 18 miles an hour, to be wholly of American construction, and to be allowed to carry only passengers with their luggage and the mails. The compensation for the mail service is to be $12,500 for each outward-bound trip made within six days, $10,000 for each trip made within seven days, $7,500 for each trip within seven and a half days, and $5,000 each for more than seven and a half days. The Government is to have the right to take the vessels for its own use in case of war of payment of not more than the cost. As without freights the steamers ought to be able to make weekly trips, they would be able to earn $25,000 per year, which would be a handsome subsidy. Fort Pond Bay is at the extreme eastern end of Long Island, about a hundred miles from New York, and is easily accessible by the Long Island Railway, which can be easily extended to the Point. The applicants for this subsidy are the same capitalists with whom Mr. William Pearce, of Messrs. Elder & Co., was in consultation during his recent visit here.

ERICSSON'S TORPEDO.—The Ordnance Bureau in the American Navy Department who conducted the recent experiments with Ericsson's Torpedo Boat Destroyer have reported to Congress that the projectile is of the most formidable character, and within a limited range is superior to anything of the kind. Admira Porter says, however, that while torpedoes of this kind are powerful adjuncts for harbour defence, they are nothing more, and thinks no torpedo can do away with the necessity of building heavy ships.

NOTICE.—Owing to great pressure on our space, we are obliged to hold over the article on "Our Royal Marine Engineers and Engine Room Artificers" until our next issue—ED. M.E.

* OCEAN STEAMSHIP MACHINERY.

A SERIES OF PRACTICAL PAPERS ON THE DESIGN, CONSTRUCTION, AND MANAGEMENT OF THE MACHINERY OF STEAMSHIPS.

By H. Holt-Butterfill, Marine Engineer.

Continued from page 225.

I.—The Problem of Ocean Steam Navigation.

VESSELS propelled by paddle wheels to which motion was given by the application of steam-power, had up to within nearly half a century ago been successfully employed in river and lake service, and on coasting voyages, both in Great Britain and America and on the continent of Europe. But had any person at that period ventured to assert that a steamship could be constructed to propel herself across the Atlantic, a distance of 3,000 miles, carrying fuel sufficient for the passage, a cargo that would be remunerative, and provisions and stores enough for her passengers and crew, he would in all probability have been deemed a philosophical dreamer, and not worthy of attention. Yet the possibility of such an achievement formed, about this period, the subject of very warm debate; and it is reported of a learned philosopher of that day that he declared that one might as well think of making a voyage to the moon as to think of ever getting to New York by steamship; that it was in fact an *impossibility*.

The solution, however, of this—at that time—knotty problem was destined soon afterwards of early accomplishment, thanks to the enterprise of a few British and American merchants, the skill of English and Scotch engineers and shipbuilders, and the courage and good seamanship of two lieutenants of Her Majesty's Navy.

In the year 1837 there was built to the order of the St. George's Steamship Company, by Messrs. Menzies, of Leith, a wooden paddle-wheel steamship called the *Sirius*. She was 178 feet long, and about 750 tons burden. Her engines, which were made by Messrs. Wingate & Co., of Glasgow, were a pair of the side lever type, and of 270 horse-power collectively.

About the same date, Mr. Paterson, a well-known shipbuilder of Bristol, was building to the order of the Great Western Steamship Company, of that city, a wooden paddle-wheel steamship called the *Great Western*. She was 236 feet over all, 36 feet beam, 23 feet deep, and of 1250 tons burden. Her engines, which were also a pair of the side lever type, were of 440 horse-power, built by the subsequently noted firm of Maudslay & Field, of London.

The boilers of these vessels were of the then prevailing type for marine purposes, viz., *flue* boilers, or those in which the heat was communicated to the water by means of a winding flue passing through it, and which conducts the smoke and heated gases to the funnel. Economy of fuel being of vital importance in this first attempt to accomplish the Atlantic passage by steam, great care was taken by the Messrs. Maudslay & Co. in the design and construction of the boilers of the *Great Western*.

The *Sirius*, chartered by the British and American Steamship Company, and under the command of Lieut. Richard Roberts, R.N. (afterwards lost in the ill-fated steamship *President*), started from Cork (now Queenstown) on the 4th April, 1838, and after burning all her coals—about 400 tons—as well as all combustibles in the shape of wood, tar, &c., on board, barely succeeded in reaching Sandy Hook—20 miles below New York—by midnight of the 22nd. Coals were sent to her from New York, and she anchored in that harbour about noon of the 23rd April, 1838.

The *Great Western* under the command of Lieut. (now Admiral) James Hosken, R.N., left Bristol on the 8th April, 1838—four days after the *Sirius* left Cork—and arrived in New York about two hours after the *Sirius*, having 80 tons of coal still on board, or sufficient for two or three days more steaming.

The *Sirius* was taken off the line after a second voyage, but the *Great Western* kept it for several years, and was in fact the successful pioneer of the Atlantic line of steamships.

The arguments against the commercial feasibility of such a traffic as that proposed to be established between Great Britain and America by means of steamships in competition with sailing vessels, were, by the successful voyages of the *Sirius* and *Great Western* practically demolished, and from that time to the present the development of ocean steam navigation has been continuously progressive. A gradual increase has been made in the size and speed of steamships, and their capabilities for performing long ocean voyages practically assured.

Two years after the pioneer voyage of the *Great Western*, the Cunard company was formed, and the *Britannia* built and engined by Messrs. R. Napier & Sons, of Glasgow, a paddle wheel steamer 207 feet long, 34 feet broad, and 22 feet deep, fitted with side lever engines of 405 horse-power was placed on the line to New York. She was soon afterwards followed by other vessels of the same Company of larger size and greater power.

Up to the advent of the *Persia* and *Scotia*, which were built of iron, all the preceeding vessels were of wood. The *Scotia*, launched in 1861, which was the last of the paddle-wheel boats of the Cunard Company, was an iron vessel 366 feet long, 47 feet 6 inches broad, and 30 feet 6 inches deep, her tonnage being 4050, or about 5½ times that of the first mentioned steamer, the *Sirius*.

Although the *paddle-wheel* had been adopted as the propelling instrument in all the foregoing Atlantic steamships, another means of propulsion for large vessels, viz., the *screw propeller*, was rapidly growing into favour with steamship owners. And here again the same persons, the owners of the *Great Western* steamship were the first to make trial of it on a large scale. For this purpose they (1843) commissioned a noted engineer of the time, afterwards Sir I. K. Brunel, C.E., to design for them a ship called the *Great Britain*, to be made of iron, and to be fitted with a screw propeller as her means of propulsion. She was built at the G. W. S. Company's own works at Bristol, under the inspection of Mr. Paterson (the same gentleman who designed and bulit the *Great Western*) and a Mr. Guppy. She was 322 feet long, 50 feet broad, 32 feet deep, and 3000 tons burden, and was fitted with two geared engines of 1000 horse-power, collectively driving a wrought iron propeller of 6 blades, 16 feet diameter. This vessel after being brought round from Bristol to London, where she was exhibited at Blackwall for some time, finally sailed under the command of Lieutenant J. Hosken, R.N., from Liverpool for New York on the 26th July, 1845, where she arrived after a passage of nearly fifteen days, her average speed being a little over 9 knots an hour. This, in every respect, wonderful vessel for her time was, we believe, the first screw propelled steamship that had ever attempted the Atlantic passage. An American ship called the *Savannah* had, it is true, some 30 years previously essayed to make the passage from New York to Liverpool with a *so-called* screw propeller, but actually sailed nearly all the way and did not attempt any further experiments.

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* The Author reserves the right of re-publication and translation of these papers.

Two new lines of steamships to ply between Liverpool and New York commenced running in 1850. One was the Collins line of American steamers, their first vessel on the route being the *Arctic*, a wooden paddle wheel vessel, and the other, the now famous Inman line, their first ship being the *City of Glasgow*, an iron screw steamship of 1600 tons burden. She was 227 feet long, 32 feet 6 inches broad, and 24 feet 6 inches deep, fitted with geared beam engines of 380 horse-power, driving a propeller 14 feet diameter.

Although the Collins line of steamers have long ceased running, they were the means of a faster and more powerful class of English steamers being put on what has since acquired the name of the "Atlantic Ferry." The rival line, the Cunard had previously made the *outward* passage in 297 hours, and the *homeward* one in 275. When the American steamers were put on, the *outward* passage with them averaged 272 hours, and the *homeward* one 263 hours.

To compete successfully with these, a larger, more powerful, and better appointed class of vessels, of which the *Persia* was a type, was put on from the English side. This typical vessel was a splendid specimen of an Atlantic liner of her day. Her hull and machinery were the perfection of workmanship. Her engines, of the same type as fitted in all the previous Cunarders, viz., side levers, had cylinders 100 inch diameter and 10 feet piston stroke, and indicated 3600 horse power, with which she attained an average speed of nearly 13 knots, and made the passage between Queenstown and New York in 10½ days.

At the date (1856) of the building of the *Persia*, *iron* had for steamers of large size entirely superceded *wood* as a material of construction, and the *screw* as an instrument for their propulsion had also to a very large extent taken the place of the *paddle wheel*. But there were other causes at work which helped to render large wooden paddle wheel steamships unfitted for the Atlantic or other ocean service.

To provide for cases of heavy weather on the passage out or home it was necessary that the vessels on this service should have a sufficiency of coal-bunker capacity. The consumption per day of such vessels as the *Persia* averaged from 130 to 150 tons, and for an average run of 10½ days, at a mean of 140 tons per day, this would require coal-bunker space for nearly 1500 tons. This together with that occupied by the class of engines and boilers fitted to the *Persia* would be so great that she would be unable to carry any weight of cargo without immersing her paddle-floats too deeply, thus putting her in unfavourable competition with other vessels capable of carrying greater weights at a higher speed on the same draft of water. Another drawback to the continued use of wooden steam vessels of large size was found in the difficulty of making them of sufficient strength to withstand the heavy strains to which large ships are subjected in such seas as are met with in the Atlantic and other oceans.

Up to the time (1856) of the building of the *Persia*, the ratio of length to breadth of most of the wooden steamships did not in any case exceed 6¼ to 1; but on the introduction of iron, as the, material of construction, it was found that practically there was no limit to the length of a ship, and that her strength could be made to suit almost any requirements so long as the scantling of her frames and plating, &c., was kept within the possibilities of manufacture and subsequent manipulation while building. Thus, the length of the *City of Glasgow*, of the Inman line, built in 1850, was equal to seven times her beam, and that of the *Persia*, built in 1856, to nearly eight times her beam; this proportion in the still more recently built vessels continuing to increase.

The first screw-propelled ship of the Cunard line was, we believe, the *China*, her dimensions being, length, 326 feet 2 inches; breadth, 40 feet 4 inches; depth, 27 feet 6 inches; and gross tonnage, 2638; her engines being of 420 horse power.

The commercial feasibility and practical accomplishment of the Atlantic passage in 1838 by the *Sirius* and *Great Western* was no doubt the incentive to the formation of the West India Mail Steam Packet Company, who commenced running a class of paddle-wheel steamers similar to the *Great Western* and *Britannia*; their first vessel leaving Southampton in 1841. Some of the earliest of these vessels were, we believe, built at Northfleet Dockyard, on the Thames, by the then noted wooden shipbuilder, Mr. William Pitcher.

Now, from 1838 to 1856, nearly all the then existing ocean steamships, both screw and paddle wheel, laboured under the great disadvantage of being fitted with the old type of low-pressure jet-condensing engines and flue boilers, a type to which, at the later date, all the older firms of engine builders, as well as the marine superintendents of the steamship companies, seemed persistently to adhere, notwithstanding the very great improvements which had then been made in steamship machinery by one or two rising firms of marine engineers.

(*To be continued.*)

MESSRS. MERRYWEATHER & SON'S PATENT STEAM FIRE ENGINE, FOR FIRE FLOATS, STEAM TUGS, SHIPS OF WAR, &c.

ONE of the greatest disasters it is possible to imagine is that of a destructive fire, involving, as it does, serious loss of property and endangering human lives. Both on land and sea a fire of any dimensions causes an inconceivable amount of horror and misery. In the case of a fire on land, if in one of our large towns, plenty of assistance is very soon obtained; if in an isolated part of the country, should it become impossible to save the burning pile, the occupants, in nearly every instance, are enabled to reach "terra firma," and escape with their lives. On the other hand, should a serious fire take place on board ship at sea, the work of extinguishing the conflagration rests solely with the crew and the appliance with which the vessel may be fitted. No help can be obtained from any quarter, and should the mariners be unsuccessful in mastering the flames, which spread with such rapidity on board ship, not only is a costly fabric and valuable cargo entirely lost, but in every probability the whole of the crew either sacrificed in the flames, or swallowed up by the sea.

Many are the causes by which vessels of all descriptions are rendered liable at any moment to an outbreak of fire. The accumulation of gas in the coal bunkers, or in the holds of vessels laden with coal, the effect of damps or heavy working of the vessel on some cargoes, the improper storage of inflammable spirits, and the danger of being struck by lightning, are a few of the causes of fire on board ship which cannot always be avoided. The costly floating machines of men-of-war of the present day are also liable to being fired by one of the many modes of attack invented to destroy an opponent by means of burning. Again, should a vessel be lying in dock in close proximity to other valuable vessels and cargoes, or perhaps with her lofty spars and above-deck fittings overlapping storehouses containing bonded stores of fabulous value, a fire breaking out in this vessel, which could not be checked with the greatest promptitude, might work fearful havoc and ruin. Considering the immense value of our ocean-going vessels, with their machinery and the cargoes they carry, it is one of the chief duties of the shipbuilder, ship owner, and naval architect to provide the best possible means of coping with an agent so destructive to life and property.

Amongst the different inventors of fire engines and fire extinguishers for use on sea or land, Messrs. Merryweather and Sons have for many years held a leading position.

Figs. 1 and 2 on the illustrated page show a longitudinal section and plan of a twin-screw steam launch fitted with a steam fire engine of "Merryweather's Admiralty Pattern," as supplied to the Admiralty for the Royal Dockyards, and to the French, German, and other Foreign Governments. The launch is 45 feet in length, 8 feet beam, with a draught of water of 2 feet forward, and 2 feet 10 inches aft, and a total depth of hold of 4 feet 6 inches. The propelling engines are two in number, each working a gun-metal screw, 28 inches in diameter. The cylinders are each 5¾ inches in diameter, with a 6-inch stroke, the number of revolutions on trial were 280 per minute, and the steam pressure 75 lbs. per square inch. These engines work independent of each other in order to facilitate the manœuvring of the launch amongst shipping. The speed attained averaged over ten miles per hour.

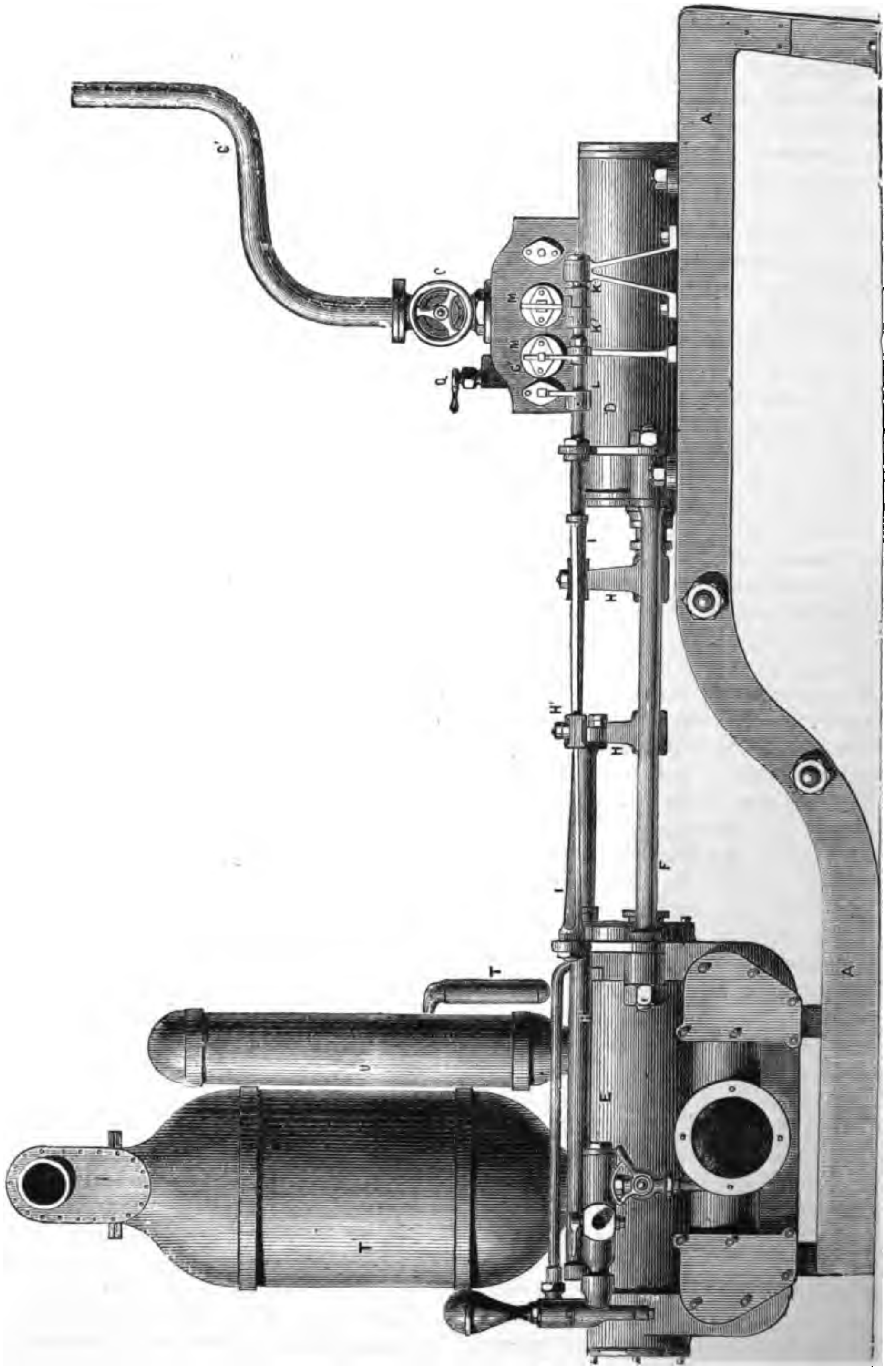
The boiler is on the Field principle, and is arranged to drive the propelling engines and steam fire engine simultaneously, in order that the launch, by acting as a tug, may be engaged in towing a burning vessel away from surrounding shipping, &c., at the same time pouring jets of water on the flames.

This boiler contains 426 Field tubes, giving 236 square feet of tube surface and 35¼ square feet of firebox surface. It also has a large water and steam space—steam can be got up to 75 lbs. pressure in the space of 10 minutes. It is fed by feed pumps attached to each propelling engine, by another long-stroke feed pump on the fire engine, also by an arrangement by which the whole supply of the fire engine pumps, 11·6 gals., can be forced into the boiler by one stroke, and, lastly, by a Giffard's injector. The steam fire engine, whilst limited in weight and space, is of sufficient strength to stand the rough usage to which such machines are usually subjected. The pumps have a steady stroke of 24 inches. There is no dead point in the course of the pistons, and the engine will start with the latter at any position in their stroke as soon as steam is turned on. The engine can be worked at full speed or any intermediate speed, in the event of a limited supply of water, even as slow as one or two strokes per minute. The pumps are arranged to throw water combined with mud, seaweed, shavings, or gravel, the valves being specially adapted for this purpose. The pumping power is very great, being 1,000 gallons per minute through a jet 1¾ inches in diameter to a height of 212 feet. It is arranged to pump four jets, each 1 inch in diameter, which can be thrown to a horizontal distance of 200 feet. These pumps are fitted with suitable connections for pumping out the holds of sunken vessels at the rate of 1,200 gallons per minute. In the fore part of the vessel is a cabin with sleeping accommodation for several firemen if necessary, and at the after part is a large hose-reel which will carry some thousands of feet of fire hose.

Figs. 3, 4, and 5 show enlarged views of the pumping engines of the float or launch. In Figs. 3 and 4 the pumping engines are fixed on a stont angle iron frame, which may be fitted to any steam vessel, and worked by an attachment to the main boiler.

The valves, which are of gun metal, are suitable for pumping foul water, as explained in the description of the steam launch fire engine, without fear of being choked. The engine is arranged for fire purposes, with four outlets as shown, but for general pumping purposes only one outlet is attached of large diameter. In raising the *Eurydice* 11 inches of water was pumped

FIG. 4.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ELEVATION.

MERRYWEATHER & SONS' STEAM FIRE ENGINE.

from the hold in five minutes by means of one of these pumps. Fig. 5, shows the pumping engine fixed on a bed-plate of cast iron.

It will be noticeable that these engines have no cranks or fly-wheels. They work with a long steady stroke, thereby reducing the wear and tear; the valve motion is worked by twisted bars as shown, and the pistons are cushioned by the full pressure of steam at the completion of every stroke, on this account it is impossible for the pistons to strike the cover, even when in the most unexperienced hand. The valve motion is so constructed that the engines will start in in any position.

From the foregoing descriptions of the extensive ravages to which vessels and cargoes are rendered liable in case of fire, it will be seen that a steamer fitted with a fire engine of this kind is prepared at any moment, and under any pressure of steam, to bring a most effectual extinguisher to operate on any fire that may break out, and, on the other hand, in the case of a vessel by any means being in a leaky condition, the amount of water that can be thrown out of the hold per minute, would keep her afloat when no other means would prevent her from sinking. The saving of wear and tear on the crew, which is always a great strain on them in pumping out a leaky vessel, is also a great consideration. Vessels fitted with this appliance might in foreign ports, where a fire frequently destroys the greater portion of a town if lying alongside wharves, be most instrumental in checking the progress of the flames. Men of war would reap a great advantage by being able to extinguish any outbreak of fire either in peace or war, or to keep under water entering the ship from any number of ordinary leaks. In the case of steam launches or fire floats fitted with Merryweather's Admiralty Pattern Fire Engine, they are most useful adjuncts to any fleet, and also of the greatest assistance in extinguishing fires which take place in towns near the banks of rivers. The examples of the immense service, rendered at different times by fire floats on the river Thames, would fully exemplify the usefulness of fire engines afloat.

At the same time the Stationary Steam Fire and Pumping Engine as illustrated in plan Fig. 3, in elevation Fig. 4, and a general view in Fig. 5, besides being of great use on board ship is also extensively used for mills, waterworks, mining, sewage and other general purposes for use on land.

The many advantages combined in this fire engine for service either afloat or on shore, is a great step towards securing a tolerable amount of safety from the dreaded ravages of fire, and also provides a ready pumping medium for many different purposes which alone is of the greatest use and value.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Friary.—On January 21st, from Deptford-yard, Sunderland, Mr. Laing launched a steamer of about 4,000 tons capacity, classed 100 A 1 at Lloyd's, designed expressly for the regular line between Plymouth and New York, owned by Messrs. Jones, Brothers & Co., of Newport (Monmouthshire). On leaving the ways she was named the *Friary* by Miss Swainston, of Sunderland. The vessel has three decks, and has been built with unusual strength and special fittings for the American and Indian trades. She will be supplied with engines of 280-horse power by the North-Eastern Engineering Company, and with all equipments of the most improved character. Her length is 295 ft.; breadth, 38 ft.; and depth, 27½ ft. Mr. Laing is also building another vessel for the same line.

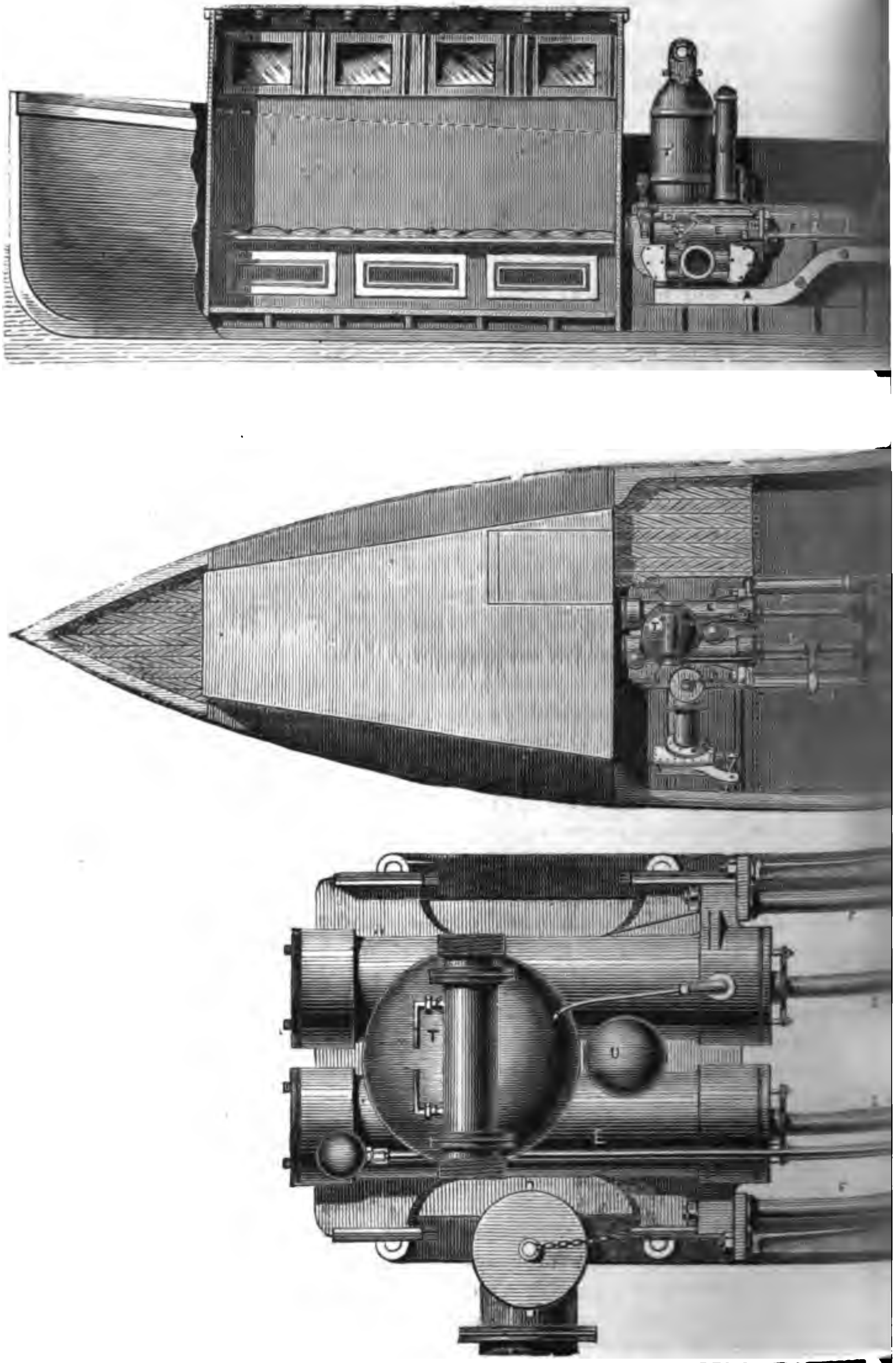
Orialla.—On January 25th Messrs, Thos. Royden & Sons, Liverpool, launched from their yard the *Orialla*, of 1,780 tons, built to the order of Messrs. Sandbach, Parker & Co., and to class 100 A 1 at Lloyd's. She is an iron vessel, and her dimensions are as follows:—Length, 245 ft.; breadth, 40 ft.; depth, 23 ft. 3 in.

Drachenfels.—On January 28th there was launched from the yard of the Sunderland Shipbuilding Company (Limited) an iron screw steamer, built for the Hansa Steam shipping Company, of Bremen. The vessel is built on the three-decked grade, with poop bridge and forecastle, and will take the highest class at Lloyd's, and also at Veritas, with extra strength above their requirements. Both main and upper decks are of iron. She is fitted with water-ballast fore and aft on the cellular principle, and has four steam winches, Harfield's patent capstan windlass, Bow, M'Lachlan & Co.'s hand and steam steering gear, and all the latest improvements for rapid economical working. The steamer is to be rigged as a brigantine, and has accommodation beneath the bridge amidships for the officers, while a saloon aft is provided for passengers. Her dimensions are:—Length, 310 ft.; breadth, 37 ft. 6 in.; depth, moulded, 25 ft. 9 in. Gross tonnage about 2,200, and is provided with engines of 200 nominal horse power, with large boilers, and all the latest additions in marine engineering, by Messrs. Black, Hawthorne & Co., of Gateshead. On leaving the ways she was named *Drachenfels* by Miss Robinson, daughter of Mr. W. S. Robinson, solicitor, Sunderland.

City of Bristol.—On January 31st Messrs. Edward Withy & Co. launched from Middleton Ship Yard, West Hartlepool, a finely modelled iron screw steamer, named the *City of Bristol*, which has been built to the order of Messrs. Palgrave, Murphy, & Co., of Dublin and London, under the inspection of their marine superintendent, Captain R. Carnegie. Her principal dimensions are:—Length between perpendiculars, 235 ft.; beam extreme, 32 ft. 6 ins.; depth moulded, 18 ft. 1 in. She has double bottom all fore and aft on the "cellular" principle, long full poop, topgallant forecastle, iron main deck, 'tween deck in each hold, four steam cranes, one winch, and Higginson's patent steam quarter master. She will class 100 A 1 at Lloyd's, and will have Board of Trade Passenger Certificate, being fitted for the accommodation of first class passengers. Her engines are 150 nominal horse-power, and will be supplied by Messrs. T. Richardson & Sons, of Hartlepool Iron Works. These are the twelfth pair of engines supplied by the same builders, and are expected to give the steamer a speed of 11 knots.

Paolo.—On February 1st there was launched by Messrs. S. P Austin & Son, Wear Dockyard, Sunderland, an iron screw steamer. named the *Paolo*, built to the order of Messrs. A. C. de Freitas, of Hamburg, under the superintendence of Mr. Petersen. She is of the following dimensions, viz.:—Length over all, 233 ft.; extreme breadth. 32 ft.; depth of hold, 16 ft. 6 in.; gross tonnage, 1,100 tons; nett, 700 tons; coustructed with long break, bridge house, and topgallant forecastle, iron decks. She will be fitted with compound surface-condensing engines by Mr. George Clark, Southwick, of 120-horse power nominal, and will be provided with Emerson & Walker's patent windlass, three steam winches by Clark, Chapman & Gurney, and all the latest improvements.

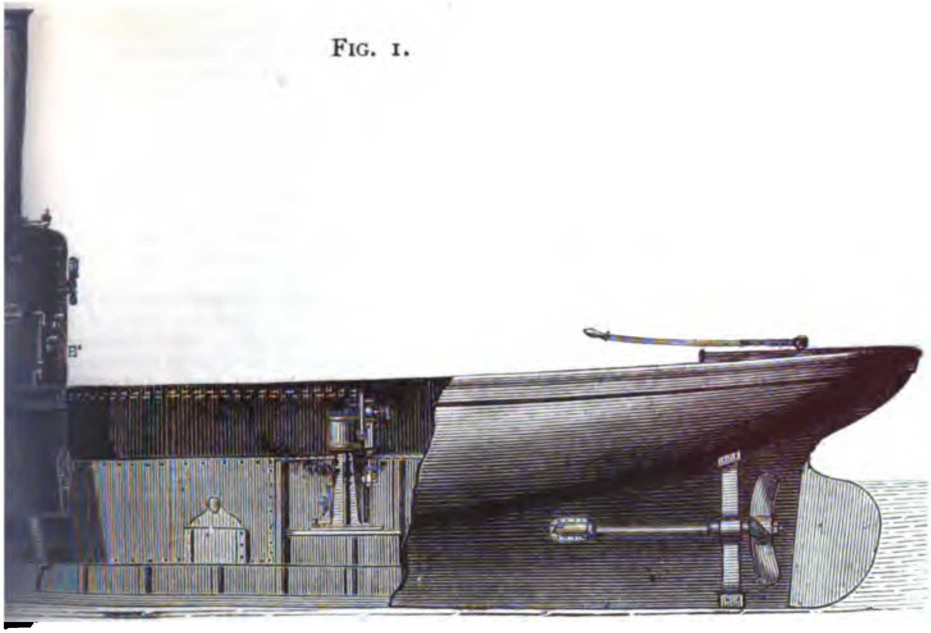
Socrates.—On February 2nd there was launched by Messrs. C. S. Swan and Hunter, Wallsend, an iron screw steamer of 3,000 tons burthen, for the Atlantic and East Indian trades. The vessel

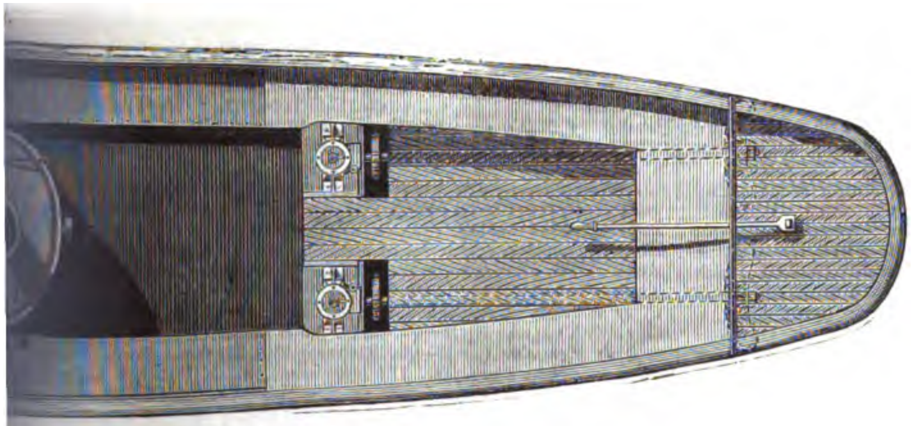


LONGITUDINAL SECTION.

MERRYWEATHER & SON'S PATENT

FIG. 1.





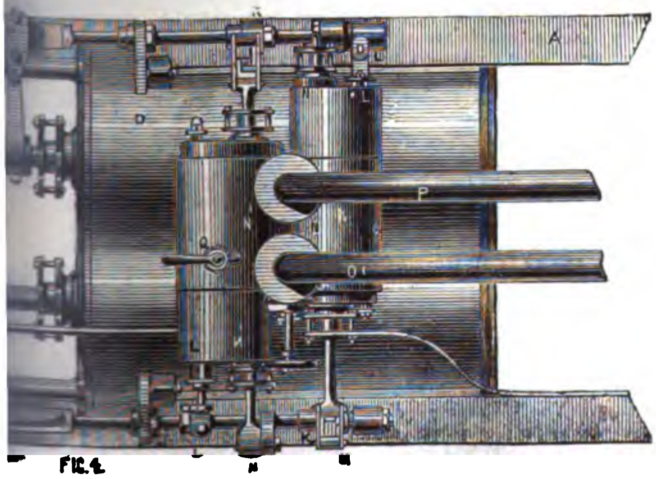


FIG. 4.

[FIRE ENGINE.—(*For Description see Page* 262.)

was named the *Socrates, pro tem.*, and will be fitted with engines of 250 nominal horse power, by Messrs. R. H. Hawthorn, Newcastle.

Joseph Arbib.—On February 2nd there was launched from the yard of Messrs. Raylton, Dixon & Co. an iron screw steamer, built to the order of Messrs, J. Arbib & Co., of London. Her dimensions are :—Length over all, 279 ft.; breadth, 35 ft.; depth of hold, 24 ft. 3 in.; and her deadweight capacity will be about 2,700 tons. She is built on the three-deck rule, with main deck of iron, water ballast in main and after holds, with poop aft for accommodation of officers and passengers, a bridge, with accommodation houses underneath, steam steering gear, and all the latest improvements in this class of vessel. Her engines will be 170-horse power, by Messrs. T. Richardson & Son, of Hartlepool. The vessel and engines have been built under the superintendence of Mr. Casey, who was present on behalf of the owners at the launch, of London, and, on leaving the ways, she was named the *Joseph Arbib* by Miss Bessie Dixon.

Inflexible.—On February 4th there was launched from the yard of Messrs. Short:Brothers, at Pallion, Sunderland, an iron screw steamer, built to the order of Messrs. Anderson, Horan, & Co., Sunderland, of the following dimensions and particulars :—Length between perpendiculars, 280 ft.; breadth, 38 ft.; and depth of hold, 27 ft. 6 inches, with a deadweight carrying capacity of about 3,250 tons. The vessel has been built to the highest class in Lloyd's Registry, under special survey, is constructed on the spar deck principle, and is fitted with long bridge over engines and boilers, with accommodation for officers, &c. The saloon is under the spar deck aft, and the vessel is divided into five water-tight compartments. The cargo can be worked from four large hatchways by a powerful steam winch at each. She has water ballast in fore and aft holds, and under engine and boilers, and is fitted with Emerson & Walker's windlass, and Bow, M'Lachlan, & Co.'s patent steam-steering gear, while the winches and donkey boiler are supplied by Messrs. Clark, Chapman, & Gurney, of Gateshead, and include all the latest improvements for despatch in working the vessel. On leaving the ways she was named the *Inflexible*, the ceremony of christening being performed by Mrs. Nuttall, of the Oaks. The vessel is to be fitted with engines and boilers of 180 horse-power, by Mr. John Dickinson, Monkwearmouth, with all the latest improvements in marine engineering.

DEPOSITING DOCK.—On February 4th the Barrow Shipbuilding Company launched from their yard a new depositing dock, built on Clark and Stanfield's patent, capable of accommodating vessels of nearly 3,200 tons displacement. It is built of iron, in the shape of the letter L, there being a series of twelve pontoons, each divided into four water-tight compartments by three transverse bulkheads, thus making forty-eight water-tight compartments. When a vessel requires to be docked for repairs, &c., the pontoons are sunk by being filled with water, and the vessel is placed on the top of them. By means of pumping the dock is made to float, and the vessel can if necessary be carried to a permanent staging now in course of erection on Old Barrow Island, where it can be deposited by the sinking of the pontoons, and the dock is thus released for a second vessel if occasion should require it. The dock can be extended in length and increased in power so as to dock and deposit vessels of 5,000 tons or even 6,000 tons displacement. A similar dock has been built and is now in successful operation in the south of Russia.

Treneglos.—On February 4th there was launched from the shipbuilding yard of Messrs. John Readhead & Co., South Shields, an iron screw steamer of the following dimensions—viz., 249 by 36 by 17½. The vessel has been built for Messrs. Edward Hain & Son, St. Ives, Cornwall, and will be classed 100 A 1 at Lloyd's. She will be fitted with engines of 120 horse-power, also built by Messrs. Readhead, and with Harfield's patent windlass, four steam winches, water ballast, six iron bulkheads, and all other modern requirements to fit her for a first-class Mediterranean boat. The vessel was named the *Treneglos* by Mrs. James Readhead.

Esk.—On February 4th a fishing smack was launched from the dockyard of the Whitby and Robin Hood's Shipbuilding and Graving Dock Company. Her dimensions are as follows :—Length extreme between perpendiculars, 74 ft. 6 ins.; extreme breadth, 19 ft. 9 ins.; depth of hold, per measurement, 10 ft. In all respects she will be fitted with all approved modern appliances for facilitating her movements, more especially in regard to the discharging of her cargoes. As she left slipway she was christened the *Esk* by Miss Robinson, daughter of Mr. B. Robinson, Esk-terrace.

Salerno.—On February 4th, Messrs. Osborne. Graham, & Co. launched from their yard at Hylton an iron screw-steamer. named the *Salerno*, built to the order of Messrs. R. W. Jones & Co., of Newport (Mon.). The vessel is of the following dimensions :—Length between perpendiculars 235 ft, by 33 ft. beam, and 16 ft. 9 in., depth of hold, to be classed 100 A 1 at Lloyd's. She will be fitted with compound engines by the North-Eastern Marine Engineering Company (Limited), of 120 horse-power, nominal, with cylinders 30 in., and 55 in., diameter, by 36 in., stroke. The vessel is provided with all appliances for rapid loading and discharging and with all recent improvements. There are three steam winches and donkey boilers, and she has a complete outfit, besides large hatches and shifting boards to enable her to pass the Board of Trade under the Grain Cargoes Act. On leaving the ways she was named by Mrs. Le Pelley, wife of Captain Le Pelley, who will take command.

Ealing.—On February 4th, a screw-steamer was launched from the building yard of Messrs. Hodgson & Soulsby, Blyth, of the following dimensions :—Length over all 292 ft.,; breadth extreme, 36 ft.,; depth of hold, 24 ft.,; carrying capacity, 3,000 tons—or say 12,500 qrs of heavy grain, besides 200 tons of fuel. The engines are compound direct acting surface-condensing 250-horse power nominal, and have been built by Messrs. R. & W. Hawthorn, Newcastle. The vessel has been built to the order of Messrs. Watts, Ward & Co., of London, Newcastle and Blyth, and is the second steamer constructed for this firm by Messrs. Hodgson & Soulsby. As the steamer glided down the ways she was named the *Ealing*, by Miss Arnison of Newcastle.

Boston City.—On February 6th Messrs. William Gray & Co., West Hartlepool, launched an iron steamship, to the order of Messrs. Thomas Furness & Co, of West Hartlepool, for their line between that port and America. Her dimensions are :—Length, 280 ft. breadth, 40 ft. depth 22 ft. 6 in., carrying capacity 3,000 tons deadweight. The engines of 250-horse power, will be supplied by Messrs. Blair & Co., of Stockton-on-Tees. She will be furnished with all the latest improvements, including water condenser capable of supplying 500 head of cattle and a large number of small stock, fittings for carrying which will be arranged on an entirely new plan, enabling the steamer to carry general cargo on her cattle decks when not occupied by live stock. On leaving the ways she was named the *Boston City*, by Miss Dora Furness. The *Boston City* was built under the superintendence of Captain T. King, the company's superintendent at West Hartlepool.

Haidar-Pasha.—On February 6th the steamer *Haidar-Pasha*, built to the order of Mr. W. J. Alt. for the Haidar-Pasha to Ismid Railway, was launched from the building yard of Messrs. Samuda Brothers, and was christened by Miss Mabel Alt. She is a paddle-wheel vessel, intended for crossing the neck of the Bosphorus and working in conjunction with the Ismid railway, and is 155 ft. long by 22 ft. with large deck accommodation for passengers, and is fitted with engines by Messrs. Maudslay & Field.

Lady Longden (s.s.).—On February 6th Messrs. Forrestt & Sons launched from their Britannia yard, at Millwall, a finely modelled steamer of the following dimensions :—Length over all, 125 ft.; length between perpendiculars, 120 ft.; breadth extreme, 20 ft.; depth moulded, 8 ft. 8 ins. The christening ceremony was performed by Miss Bond, who had been asked to represent Lady Longden on the occasion, that lady, who had promised to be present, having returned to India. The vessel is built of steel to take the highest class at Lloyd's. She is fitted with a bridge-deck amidships, poop, and topgallant forecastle. She will be schooner-rigged, and is intended to carry general cargo and passengers. The engines are of the compound condensing type, 15 ins. and 28 ins. diameter of cylinders, with a stroke of 21 ins. The vessel has been built to the order of T. A. Tambayah, Esq., of Colombo, and is intended as the pioneer vessel of a line of coasting steamers for Ceylon. Messrs. Forrestt & Son have also in hand four large iron steamers for a London firm, a large twin screw barge for H.M. Government, a powerful screw tug for London owners, four 80-ft. iron barges for India, besides numerous smaller iron and steel launches, &c.

Hesperia.—On February 7th, there was launched from the Barrow Shipbuilding Company's yard, Barrow-in-Furness, an iron screw steamer of the following dimensions :—Length, 338 ft.; breadth, 37 ft. 6 in.; gross tonnage, 3,100 tons. She will be supplied by her builders with engines of 480-horse power. As the vessel left the ways she was named the *Hesperia*, by Lady Ramsden. The *Hesperia* will be fitted with all the latest improvements, and is intended for the Atlantic trade.

Eastward.—On February 9th Earle's Shipbuilding and Engineering Company (Limited), launched from their yard a screw fishing cutter for the Great Northern Steamship Fishing Company (Limited), of Hull. The vessel was named *Eastward* by Miss Potter. This boat is built of iron, to class 100 A 1 at Lloyd's,

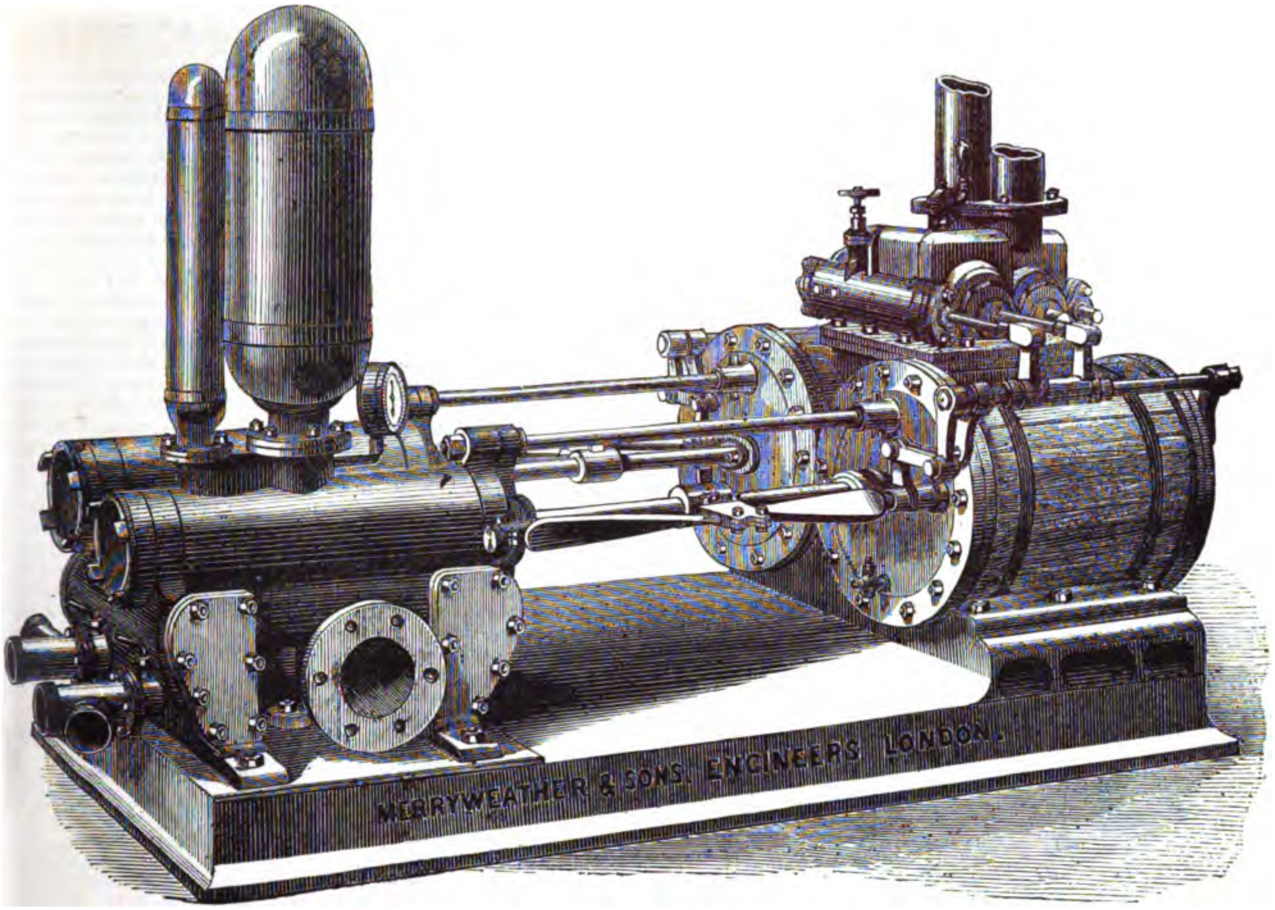

MERRYWEATHER & SONS. ENGINEERS. LONDON.

FIG. 5.—(*For Description see Page* 262.)

and is 135 ft. long between perpendiculars, 22 ft. beam, and 11 ft. deep. She has engines of 60 nominal horse power, having cylinders 21 and 40 in. diameter by 27 in. stroke, and is intended for carrying fish from the company's fleet to Hull.

Dodona.—On February 16th there was launched from the shipbuilding yard of Joseph L. Thompson & Sons, North Sands, Sunderland, an iron screw steamer, of 2,000 tons burthen, built to to class 100 A 1 at Lloyd's, and under special survey, to the order of Mr. Thomas Hick and partners, of Scarborough. After the launch the vessel was taken to the new quay of Mr. John Dickinson, where she has been engined. The engines are of 140 horse-power nominal; four steam winches, Emerson & Walker's patent windlass, Cooper & Taylor's steam stearing gear amidships, and all the modern appliances are being fitted. The accommodation for the captain and officers is in the full poop aft, being divided into fore and aft cabins; the engineer's berths are amidships, and crew accommodation in the topgallant forecastle. The naming of the vessel *Dodona* was performed by Miss Hick, of Scarborough. The *Dodona* is intended for the Mediterranean and Black Sea Trades, and will be under the command of Captain Thomas Pearson, of Scarborough.

Howards. - On February 18th Messrs. Robert Thompson & Sons successfully launched from their shipbuilding yard at Southwick, Sunderland, an iron screw-steamer for J. F. Marshall, Esq., Sunderland, of the following dimensions:—Length over all, 232 ft.; breadth, 32½ ft.; depth of hold, 16 ft., having been constructed under Lloyd's special survey to class 100 A 1. The vessel has long quarterdeck, bridge and topgallant forecastle, large hood aft covering steering gear and forming entrance to cabin, which is fitted up for captain and officers. Engineers and petty officers are placed under bridge, crew and firemen in forecastle. She has self-trimming hatches, iron plate rails, crane on forecastle, ample water ballast in both holds, also in peaks to enable vessel to trim well; steam winches and donkey boiler, Emerson, Walker & Co.'s patent windlass, Davis's steering gear amidships and screw gear aft. All deck fittings are made of iron. Schooner rig, and has all the latest improvements. Her engines are 130-horse power, by Messrs. Black, Hawthorn, & Co., of Gateshead. On leaving the ways she was named the *Howards*, by Mrs. Marshall, wife of the owner.

Pensher.—On February 18th Messrs. Short Brothers launched from their yard, at Pallion, Sunderland, a screw steamer, built for local owners, of the following dimensions:—Length, 240 ft.; breadth, 35 ft.; depth of hold, 18 ft., with a deadweight carrying capacity of 2,000 tons, The vessel has short poop, long raised quarter-deck, bridge-house over engines and boilers, and topgallant forecastle, water ballast, all fore and aft, four large hatches and steam winches, and all the latest improvements for despatch. On leaving the ways she was named the *Pensher*. She is to be fitted with engines, of 140 horse-power, by Mr. John Dickinson, with all the newest improvements in marine engineering.

Vendome.—On February 18th Messrs. Baxter & Co. launched from their yard at the North Sand Point, Sunderland, the screw steamer *Vendome*, built to the order of Messrs. Dansey & Robinson, of London, and intended for the coasting trade. The vessel, which is registered at Lloyd's in the highest class, is furnished with water ballast fore and aft, two steam winches, Emerson & Walker's patent combination windlass, bridge amidships, accommodation for captain and saloon amidships, full forecastle for crew and firemen, and all the most modern improvements. As the vessel was moving off the ways she was christened by Mrs. Baxter. The vessel has since left for the Tyne, where she will have compound engines, 60 horse-power, fitted by the Wallsend Slipway and Engineering Company (Limited). Her dimensions are as follows:—Length, 155 ft.; breadth, 23 ft. 6 ins.; depth of hold, 13 ft. 6 ins.

Dordogne.—On February 18th there was launched for the Cardiff Steam Shipping Company, Cardiff, by C. S. Swan & Hunter, Wallsend, Newcastle-on-Tyne, an iron screw steamer of the following dimensions:—Length between perpendiculars, 200 ft.; breadth, 29 ft. 3 ins.; depth, 15 ft. The vessel will carry about 1,050 tons deadweight, and is fitted with passenger accommodation, and will be employed on the line between Cardiff and Bordeaux. She will be fitted with engines 26 and 47 diameter ot cylinders, 36 length of stroke, 92 horse-power, by George Clark, Esq., Southwick, Sunderland. The vessel was named the *Dordogne* by Miss Hunter.

China.—On February 20th there was launched at Messrs. Palmer's shipbuilding yard, Jarrow, a screw steamer named the *China*, built for Messrs. R. Rubattino & Co., of Genoa. Her length is 412 ft.; breadth, 44½ ft.; depth. 31¾ ft. 3 in. Accommodation has been supplied for both first and second-clsss passengers, while the comfort of the crew has not been neglected. She has a deadweight carrying capacity of 4,500 tons, and water ballast in after hold. The vessel has been fitted with all the latest improvements. She is provided with eight boats, including one steam launch, built of steel, three cutters, also of steel, and four of wood. The engines are by Messrs. Palmer & Co., and are on the inverted, combined, self-acting, surface-condensing principle, with cylinders 54 and 96 in. respectively; 60 in. stroke, and 500-horse power nominal, with four cylindrical double-ended boilers, and two donkey boilers. The vessel is intended for the special mail service between Genoa and Bombay, and has been built under the personal superintendence of Captain Brizzolesi, of Genoa. Mrs. Price, wife of the general manager, performed the christening ceremony.

Jeanie.—On February 20th Messrs. Edward Withy& Co.launched from Middleton Shipyard, West Harplepool, an iron screw steamer, built to the order of Messrs. Coverdale, Todd & Co., of West Hartlepool. Her principal dimensions are:—Length between perpendiculars, 275 ft.; beam, extreme, 35 ft. 6 in.; depth, moulded, 20 ft. 9 in. She is built to Lloyd's highest class, and has poop, long quarter-deck, bridge-house, and topgallant forecastle extending to the foremast, double bottom all fore and aft on the cellular principle; the decks, masts, chart house, engine skylight, and cabin companion are of iron. She will be fitted with four hatches, steam winches, and patent windlass, and will be rigggd as a double topsail schooner; engines of 170-horse power wili be supplied by Messrs. T. Richardson & Sons, of Hartlepool Ironworks. This vessel is No. 105 in the builders' yard, and the fifth built by them for the same owners. She will be principally engaged in the Black Sea and Atlantic trades. On leaving the ways the steamer was christened *Jeanie*, by Miss Webster, daughter of Captain Webster, who will command her.

Middlesbrough.—On February 22nd there was successfully launched from the yard of her builders, Messrs. Raylton, Dixon, & Co., a steamship named the *Middlesbrough*, and which has been built to the order of Messrs. Hogg & Henderson, of this port. Her dimensions are:—Length over all, 250 ft.; breadth, 35 ft. 11in.; depth of hold, 15 ft. 6 in., and she will carry over 1,600 tons at 15 ft. 6 in. draught. She is built on the quarter-deck system, having bridge amidships, topgallant forecastle, iron decks, &c., according to the first class ships of this description, and she will be fitted with engines by Messrs. Blair & Co., Limited, Stockton, of 100 horse-power nominal.

LAUNCHES.—SCOTCH.

Hecuba.—On January 31st, there was launch from Messrs. Scott & Co.'s shipbuilding-yard at Greenock a crew steamer of 600 tons, which has been built to the order of Messrs. Alfred Holt & Co., of Liverpool. The dimensions of the new vessel, which was named the *Hecuba*, and is to be employed in the China trade, are as follows:—Length, 232 ft.; breadth, 32.6 ft.; and depth, 16.6 ft. Her cylinders are 22 and 46 inches, with a piston stroke of 36 in. She is fitted with an oval boiler to work to 80 lbs pressure. The new steamer was towed into the Victoria Harbour to be completed.

Norodom.—On February 1st, Messrs. Scott & Co., launched from their shipbuilding yard at Cartsdyke, Greenock, an iron screw steamer of about 430 tons register, built to the order of the Messageries Fluvials de Cochinchine, of Paris, and intended for the Cochin China trade. Her dimensions are as follows:—Length, 199 ft.; breadth, 26 ft. 3 in.; and depth, 15 ft. 6 in. Her cylinders are 24 in. and 48 in., with a piston stroke of 24 in. She is fitted with two circular boilers to work to 70 lbs pressure. As the vessel left the ways she was named the *Norodom*. The Chesapeake towed her to the East India Harbour, where she will be completed.

Lolland.—On February 1st. Messrs. H. M'Intyre & Co., launched from their shipbuilding-yard at Merksworth an iron screw-steamer of 700 tons. The vessel, which is named the *Lolland*, is built to the order of Det Lollandsk-engelske Dampskibsselskad, of Nakskov, Denmark, and is intended for the cattle trade between Denmark and Newcastle. She has an awning deck, and is fitted for cattle, is classed 100 A 1 at Lloyd's, and has all the most recent improvements in hull and machinery. Messrs. Hutson & Corbett, Glasgow, are the engineers. The *Lolland* has been built under the superintendence of Captain Fenger, who is to be her future Commander. The naming of the vessel was performed by Miss M'Intyre, Abbotsburn House, daughter of one of the builders.

Glenshee.—An iron barque of 850 tons register, named the *Glenshee*, was launched from the yard of Messrs. Alexander Stephen & Sons, Dundee. Her dimensions are:—Length, 204 ft.; breadth, 34 ft.; depth in hold, 19 ft. The vessel has been built to the order of Messrs. W. O. Taylor & Co., and is sister ship to the *Glenfarg*, which was launched last year for the same owners. Captain Wood, formerly of the ship *Glenlyon*, has been appointed to the command of the *Glenshee*. Messrs. Stephen have on hand two other ships of larger dimensions and of steel, for Messrs. W. O. Taylor & Co.

Birksgate.—On February 2nd, there was launched from the shipbuilding yard of Messrs. David & Wm. Henderson & Co., Meadowside Works, Partick, Glasgow, a screw steamer, classed 100 A 1 at Lloyd's, built under special survey, and of the following dimensions:—Length, 255 ft., breadth, 33 ft., depth 24 ft., moulded; and having a gross tonnage of 1,450 tons. This vessel is built on the cellular system, and has water ballast both fore and aft. She is fitted up with steam steering gear, three steam winches steam windlass, and all appliances for the rapid loading and discharge of cargo, and has accommodation for 50 first and 50 second-class passengers. She is built to the order of A. L. Elder, Esq., for Messrs. Simpson, of Adelaide, and intended for their colonial trade, As the vessel left the ways she was named *Birksgate* by Miss Black. After the launch the vessel was towed alongside the builders' wharf, where they will fit her with compound machinery of 1,200 indicated horse power, having all the most modern improvements. On completion she will steam out to Australia, under the command of Captain M'Kenzie, who has superintended the construction of the vessel.

Pelican.—On February 6th there was launched from the shipbuilding yard of Messrs. Barclay, Curle & Co., Whiteinch Glasgow, an iron screw steamer of 2,550 tons, for Messrs, Slater, White & Co., Leith. On leaving the ways she was named the Pelican by Mrs. James Gilchrist, 7, Kelvingrove-terrace.

Glenogle.—On February 7th the London & Glasgow Shipbuilding & Engineering Company launched from their yard at Govan, a large addition to the Glen Line fleet of tea clippers, named the *Glenogle*, for service between London and China—the managing owners being Messrs M'Gregor, Gow, & Co., Glasgow and London. The new vessel took the water in splendid style, and the ceremony of naming her was performed by Miss Reid, daughter of Mr Reid, of Kilmardinny. The *Glenogle* is the largest steamer built for the company. her dimensions being:—Length 440 ft., breadth 45 ft., depth, 29 ft., 2 in., with a gross tonnage of 4,000. She is built on the cellular system, with sharply defined lines, and to the highest class at Lloyd's and all the Board of Trade requirements. In addition, the new Glen Liner has been specially surveyed by the Admiralty officials, and put on the list of cruisers which can be used in the event of war with another maritime nation, and also for the conveyance of troops, The engines which are being built by the firm to the design and specifications of Mr. Wm. C. Roberts are of the three cylinder type, one of these being 59½ and two of 83½ in., diameter and 60 in., stroke, having all the latest and several new improvements, and when in full working order are expected to develop at least 5,250-horse power. Her equipments will include Messrs. Muir & Caldwell's steam steering gear, Messrs Napier Brothers' hand steering gear and windlass, Messrs Clarke's steam winches, and Messrs Chapman & Gurney's patent cranes. The *Glenogle*, besides carrying a large cargo, will be fitted up for a limited number of first-class passengers, and in the internal fittings teakwood will be largely used, and the saloon the saloon and berths are to be heated by steam-pipes.

Alora.—On February 7th, Messrs. Henry Murray launched from their Port Glasgow yard an iron screw steamer named the *Alora* of the following dimensions:—Length, 193 ft., breadth of beam, 27 ft., depth of hold, 14 ft., 500 tons register; and built to the highest class at Lloyds. Messrs James Howden & Co., Glasgow, will supply the engines. The *Alora* has been built to the order of Messrs. Goodyear & Co., Liverpool, and is to be engaged in trading between London and the Mediterranean. Captain Pearce will be in command.

Henry Swayne.—On February 16th, Messrs. Russell & Co., launched from their Port Glasgow yard an iron barque of the following dimension:—Length, 190 ft., breadth of beam 30 ft., 6 in., depth of hold 18 ft., 700 tons. As she left the ways the vessel was named *Henry Swayne.* by Mrs. Paterson, wife of the Captain. The *Henry Swayne* is a sister ship to the Bandeeth, and has been built for Messrs. W. & J. Lockett, Liverpool. She will load in Port Glasgow for Valparaiso.

Sherbro.—On February 18th, Messrs. John Elder & Co., launched from their shipbuilding and engineering works, Fairfield, Govana, steel screw steamer of about 1,700 tons gross, and of the following dimensions:—Length between perpendiculars, 300 ft.; breadth, 36 ft.; depth of hold, 19 ft. 11 in. This vessel is specially designed to have large carrying capacity, combined with light draught of water, and is for that reason entirely built of steel. She will thus be enabled to cross the bars, which are situated at the entrance of most of the African ports, and save the necessity of transhipping the cargo to shallow-draught vessels. The engines, which are being supplied by the same firm, are on their compound principle, with all the latest improvements, and will develop 1,200-horse power indicated, which will give a speed of about 12 knots an hour. The vessel, though intended principally for cargo, will have accommodation on deck for about 20 passengers, besides officers, engineers, and crew, and will be fitted with steam windlass, steam winches, steam steering gear, and all the latest improvements. This vessel has been built for the British and African Steam Navigation Company, of Glasgow, is classed 20 years in red at the Liverpool Underwriters' Registry, and is similar to the *Coansa* and *Malemba*, built in 1880 for the same company. As the vessel left the ways she was named the *Sherbro* by Mrs. Robert Cowan M'Kinnon, of Hillhead.

Mentmore.—On February 19th, a screw steamer was launched from Messrs. J. Key & Sons' shipbuilding-yard, Kinghorn. Arrangements had been made for the launch taking place on Saturday at 2. 30, but when all was ready a telegram from the insurance company was received warning the builders that if the launch took place then, the wind and sea being most unpropitious, it would not be at the risk of the company. Accordingly, the launch was arranged to come on Sunday at 3. 30 P.M., and it was accomplish in a most successful manner. She was named the *Mentmore*, and will trade from Liverpool. She was thereafter towed by three tugs to Leith, where she will be fitted out for the American cattle and meat trade. The customary naming ceremony was performed by Miss Bond, sister of one of the partners. The *Mentmore* will receive her engines and fittings at Leith.

Falls of Afton.—On February 20th, Messrs Russell & Co., Cartsdyke, Greenock, launched a four-masted iron sailing ship, of 1,900 tons, which has been built to the order of Messrs. Breckinridge & Co., of Glasgow, and is to be employed in the East India Trade. The dimensions of the new vessel are:—Length, 268 ft.; breadth, 41 ft.; and depth, 23 ft. 9 in. On leaving the ways the vessel was named the *Falls of Afton*.

Earl of Powis.—On February 20th Messrs Robert Duncan & Co., launched at Port Glasgow, an iron screw steamer named the *Earl of Powis*, of the following dimensions:—Length, 130 ft.; breadth of beam, 21 ft.; depth of hold, 7 ft., 6 in.; registered tonnage, 116. This steamer has been built for the Shropshire Union Canal Company (London and North-Western Railway Company), and is to trade betwean Liverpool and Chester. She has been fitted for towing barges and carrying passengers, and is classed 20 years in the Liverpool register. A pair of patent compound disconnecting twin-screw engines will be supplied by Messrs. Rankine & Blackmore, Greenock.

Alexandra.—On February 20th, a new patent hopper dredger of 500 tons, built and engined by Messrs. William Simons & Co., was launched complete from their works at Renfrew. It is the property of the Manchester, Sheffield, and Lincolnshire Railway, and has been constructed under the direction of Mr. Sacre, C. E., their engineer; it is the second hopper dredger supplied to them by this firm. This vessel is fitted with twin screws, and two sets of separate compound engines, and two boilers of 80 horse-power; its bucket girder traverses beyond the bow for the purpose of cutting shoals or dry banks, and thus dredge its own flotation down to 25 ft. depth of water; it will carry 500 tons of its own dredgings at a speed of seven miles per hour, and on board are fitted steam appliances for mooring, lifting, dreding, traversing and manoeuvring.

Arracan.—On February 21st Messrs Robert Duncan & Co. launched at Port Glasgow a screw steamer of the following dimensions:—Length 346 ft.; breadth of beam, 40 ft.; depth of hold, 25 ft.; 2,880 gross tonnage, 1,855 tons nett. As she left the ways she was named the *Arracan* by Miss Emma Thomson, daughter of one of the directors of the British & Burmese Steam Navigation. Co., Glasgow (Messrs. P. Henderson & Co., agents), for which company the steamer has been built. She has been fitted for 30 first-class and 20 second-class passengers, and has full poop, bridge, and topgallant forecastle. The *Arracan* is to be engaged in the Rangoon trade. The engines, which are to be compound direct-acting vertical, will be supplied by Messrs. Denny & Co., Dumbarton; cylinders 38 in.; and 68 in.; with 51-in.; stroke, and of 290-horse power. Immediately after the launch the *Arracan* was towed to Dumbarton.

Clan Macdonald.—On February 21st Messrs. Scott & Co., shipbuilders, Cartsdyke, Greenock, launched from their yard an iron screw steamer, of 2,800 tons register, built to the order of Messrs. Cayzer, Irvine & Co., Glasgow, the owners of the Clan Line of steamships. The dimensions of the vessel are as follow:—Length, 330 ft.; breadth, 39 ft.; and depth, 28 ft. She will be supplied from the Greenock Foundry Company with a pair of powerful compound engines, the cylinders of which are 41 and 71 inches in diameter by 48 inches stroke. She will be fitted with two double-ended boilers, 12 ft. 9 in. each by 18 ft. in length, to a working pressure of 80 lbs. to the square inch. On leaving the ways she was named the *Clan Macdonald*. After the launch the steamer was towed to the Victoria Harbour, where her engines and boilers will be put on board.

Clan Cameron.—On February 22nd a splendid iron screw steamer, of about 2.600 tons, for Messrs. Cayzer, Irvine & Co.'s Clan Line, was launched from Messrs. Alexander Stephen & Sons' shipbuilding-yard at Linthouse, and was named the *Clan Cameron* by Mrs. Ogilvie, 1, Doune-teraace, Kelvinside. This steamer is the fifth constructed for the Clan owners by Messrs. Stephen—who have three more in hand for the same line. She is built under special survey to class 100 A1 three-deck rule in Lloyd's (for which she is considerably in excess of Lloyd's requirements), and the engines, which are also by Messrs. Stephen, are of the most improved compound surface-condensing type, with cylinders 38 in. and 68 in. diameter by 45 stroke, and ample boilers suitable for a working pressure of 85 lbs. The first-class passenger accommodation is in a house aft, beautifully designed and very prettily finished; the officers are located in houses amidships, and a topgallant forecastle is provided for the crew. Great attention has been paid throughout to ventilation. The vessel is amply supplied with steam-steering gear, steam winches, and all the best modern appliances for working purposes. She has also provision for water ballast in double bottom on the bracket principle throughout, and is fitted with the extra water-tight bulkheads required by the Admiralty in order to taking a place on the list of vessels suitable for transports.

Casino.—On February 21st, Messrs. Gourlay Brothers & Company launched a handsome iron screw-steamer. The vessel is of the following dimensions:—Length between perpendiculars, 160 ft.; depth of hold, 10 ft. 3 in.; beam moulded, 24 ft.; and register, 426 tons. The vessel has been built to the order of Mr. B. B. Nicoll, of Sydney, for his coast trade between Sydney and the Richmond River. As the vessel left the ways she was named *Casino* by Mrs. J. Y. Guthrie, of Rosebery Crescent, Edinburgh. The *Casino* is a very handsome model, and is superbly fitted up for carrying a large number of passengers, the saloon being in the hurricane deck amidships, forward of all machinery, oil smell &c. She has a long topgallant forecastle, under which her second class passengers are accommodated. She is rigged with three masts, and is intended, like all the other vessels built for the firm, to carry a large cargo on a light draught. A steam revolving crane and two steam winches have been fitted, and all appliances for quickly handling cargo are of the most modern description. She is supplied by the builders with a pair of modern compound engines of about 70 horse-power nominal, and a large multitubular steel boiler, intended to drive the vessel about 10 knots. The *Casino* is built under the special survey of the Board of Trade, and classed 90 A at Lloyd's. She will be ready for sea in about three weeks, when she will leave for Australia. The *Casino* is the fifth steamer built by the Messrs. Gourlay for the Messrs. Nicoll. The steamer is fitted to carry 42 saloon and 26 second class passengers.

Helen Nicoll.—On February 21st, Messrs. Gourlay Brothers & Co. launched a handsome iron screw steamer, named the *Helen Nicoll* by Miss Maggie Nicoll, daughter of the owner. Like the *Casino*, the *Helen Nicoll* is intended for general cargo and passenger trade, and has been designed with a view to carrying a large cargo on a light draught; and to ensure a good speed a pair of the builders' high and low pressure compound engines of about 65-horse power nominal, with a large multitubular steel boiler, have been supplied. A very handsome saloon, fitted under hurricane deck amidships, with separate ladies' saloon on upper deck, combined with thorough ventilation, will meet the necessities of a warm climate. The whole of the saloon fittings are most elaborate. The *Helen Nicoll* will be rigged as a brigantine, and will carry a good spread of canvas. The passenger accommodation is amidship, forward of engines and boilers, and occupies the whole width of the ship. The appliances for cargo are very complete, there being three steam winches and large donkey boiler. Accommodation for the officers, galley, &c., is fitted on the quarter-deck. After shipping engines and boilers at the large crane the vessel will be completed with all speed and dispatched for Australia, her owner sailing with her. The dimensions of the *Helen Nicoll* are:

—Length, 157 ft.; breadth, 22 ft.; depth, 10 ft. 3 in.; and register, 383 tons. She is classed 90 A at Lloyd's. The launch was witnessed by a large party of the friends of the Messrs Nicoll.

LAUNCHES.—IRISH.

Pollie Whittaker.—On January 21st, a three-masted schooner was launched from the shipbuilding-yard of Mr. Paul Rodgers, Carrickfergus. Her dimensions are:—Length, 109 ft.; breadth of beam, 24 ft. 2 in.; depth of hold, 12 ft.; register tonnage about 192. She has been classed at Lloyd's for 12 years A 1. The ceremony of christening was performed by Mrs. Dixon, wife of Captain Robert Dixon, who will command the new vessel, which will henceforth be known as the *Pollie Whittaker*.

Mary E. Wadham.—On February 2nd a screw steamer was launched from the iron shipbuilding yard of Messrs. M'Ilwaine & Lewis, Abercorn Basin, Belfast. The vessel, which is 190 ft. long, 27 ft. broad, with 15 ft. 6 in. breadth of beam, and 850 tons deadweight and capacity, was built to the order of Messrs. George Bargate & Co., of Barrow-in-Furness. The engines are 90 nominal horse-power, and the cylinders 24 and 46 diameter, with 36 in. stroke, and she is expected to steam between 10 and 11 knots with full cargo. She has a double bottom on the bracket system, and is in every respect fitted as a high-class ship, being built under special survey, and is classed at the highest standard at Lloyd's. She was christened the *Mary E. Wadham* by Mrs. Wadham, of Millwood, Dalton-in-Furness.

British Prince.—On February 4th a very fine screw steamer was launched from the shipbuilding-yard of Messrs. Harland & Wolff, Queen's Island, Belfast. This vessel is the fifth of the same class that has been built for the British Shipowners' Company, of Liverpool, and is of the following dimensions:—Length, 420 ft.; breadth of beam, 42 ft.; gross tonnage, 4,000 tons. She is built of Siemens and Martin's steel, and will be classed 100 A1 at Lloyd's. Her engines will be 4.000-horse power. She has four masts, and the steam windlass, steam winches, and steam steering-gear will be on the most improved principle. She will probably be in a position to proceed to sea in about six weeks. The *British Prince* will be placed on the Atlantic trade, the same as sister vessels which are now running between Liverpool and Philadelphia. She is now lying in the Abercorn Basin, and will be fitted up as rapidly as possible. It may be mentioned that another vessel in the stocks will be ready for launching in a short time.

LAUNCH.—FRENCH.

Dupuy de Lôme. On February 5th the "Forges et Chantiers de la Mediterranee," launched from their Graville Shipbuilding yard near Havre, an iron screw steamer built for the "Compagnie Commerciale de Transports a' Vapeur Français" of Havre, the pioneer of a new line between Havre and New-Orleans. The dimensions of the vessel are: Length over all 390 ft. length between perpendiculars 376 ft.; breadth moulded 40 ft. Depth moulded 32 ft. tonnage net registered 2,700 tons, gross tonnage 3,400 tons. The vessel will be fitted by the same firm with direct acting surface condensing compound engines of 1,600 indicated horse-power. She will carry about 4,600 tons deadweight and has been built under special survey to the first class in "Bureau Veritas" register. She is spar-decked, with two iron decks, rigged with four iron masts and provided with the latest modern improvements for loading and discharging, five steam winches, steam windlass, Stapfer de Dudo's patent steering gear, etc., The vessel, on leaving the ways was named *Dupuy de Lôme* by Mrs G Dupuy de Lôme, daughter-in-law of the celebrated naval architect. After the launch which was accomplished most successfully on the direction of Mr. A. Marmiesse, chief constructor of the shipyard, the *Dupuy de Lôme* was towed into the Havre docks for the purpose of having the masts and engines put on board.

LAUNCH.—ITALIAN.

Birmania.—On January 29th there was launched from the shipbuilding yard of Messrs. Orlando Bros. an iron screw steamer of 3,100 tons, built to the order of Messrs. Rubatino & Co. Her dimensions are as follows:—Length, 310 ft.; breadth, 36 ft.; depth, 28 ft. She is schooner rigged, and has a raised forecastle, while aft there is a spacious dining saloon. She contains all the latest improvements for the rapid working of cargoes, including steam windlass, two steam winches, and three steam cranes; also Muir & Caldwell's patent steam steering gear, four iron ship's boats and two gigs. She will be fitted with compound surface-condensing engines of 1.100 indicated horse-power. There will be accommodation for fifty first class passengers, large dining saloon, smoking-room, lavatories, &c. The launch was in every way a success, the christening ceremony being gracefully performed by the Signora Scelsi, wife of the Prefect of Leghorn, who named the steamer the *Birmania*. Among the visitors were the two Princes of Birmany, who are studying at the Royal Italian Naval College at Leghorn.

LAUNCHES.—SWEDISH.

Asernoy.—On January 20th there was launched from the yard of the Motala company at Norrköping a twin screw steamer, built to the order of the Russian government. This steamer, which will be used for inspections of the great canal system between the lakes in Russia, is of the following dimensions:—Length, 137 ft.; breadth, 19 ft.; draught of water aft 5 ft., fore 4 ft. 6 in.; the machinery, of 50 nominal horse power, will give the vessel, which is of a very fine model, a good speed. At the same yard there was launched on January 4th a screw steamer which will be fitted with an engine of 60 nominal horse power. The company Södern at Norrköping will be the owners. The principal dimensions are as follows:—Length, 130 ft.; breadth moulded, 23½ ft.; draught of water, 9½ ft. This steamer is intended for cargo as well as passengers, and will be fitted with the latest improvements for quick despatch. The material in both these steamers is of the Motala works own make.

Oslo.—On January 31st was launched from Kockum's shipbuilding yard, Malmö, Sweden, a cargo steamer *Oslo*, built for the Christiania Steamship Company, in Norway. The steamer measures 225 ft. in length, 31 ft. in breath, and 15 ft. 3 in. depth of hold. She is spar-decked, built to Lloyd's survey class 100 A 1, and will be engined by the builders with compound engines of about 600 indicated horses. The steamer will carry about 1200 tons and is the first of two twin steamers for the same company.

LAUNCH.—FINLAND.

Murmansky.—On January 26th Messrs. Wm. Chrichton & Co., launched from their shipbuilding yard at Abo, Finland, an iron screw steamer, built for a Company in St. Petersburg, who are already the owners of several steamers trading on the Murmansky Coast and Wardoe Islands in the White Sea. This steamer which has the highest class French Lloyds is of the following dimensions: length, 167 ft., breadth, 22 ft., depth of hold, 11 ft., and has a draught of 8 ft. She is to be fitted with a compound surface condensing engine of 360 indicated horse power, water ballast, steam winches and all the latest improvements, and is to be ready for sea by the 1st of June. The keel of the *Murmansky* was laid in the end of September last, she having thus been built in the short time of four months. A launch at this time of the year in Finland is of rare occurrence, and could not have taken place if the winter had not been so unusually mild as it is, seeing that the river, where the before-mentioned vessel was launched, would under ordinary circumstances have been frozen over with ice 3 ft. thick.

TRIAL TRIPS.

Ranelagh.—On January 27th the *Ranelagh* (s), built and engined by Messrs. John Key & Sons, of Kirkcaldy, was taken out of the harbour and underwent a most satisfactory trial. The distance run was on each occasion five miles, being between Inchkeith and Oxcar Beacon, which was run both with and against tide, giving the following results:—First run, with 70 revolutions, 25 min. 50 sec. equal to 11·615 knots against wind and tide; second run, with 76 revolutions, 20 min. 53 sec., equal to 14·40 knots with wind and tide, giving a mean speed of 13·1 knots per hour, being three-quarters of a knot per hour above the guaranteed speed. The following are the principal dimensions of the vessel:—Length, 204 ft.; breadth, 29 ft.; depth of hold, 19 ft. 2 in. The engines are 160-horse power nominal, having cylinders 30 in. and 60 in., with 39-inch stroke, capable of developing 1,000-horse power indicated. The steamer is built to the order of the Australian Steam Navigation Company, and sails for Sydney direct.

Caliban.—On January 27th, the screw steamer yacht *Caliban* made a most successful trial at sea. She has been built to the order of a French nobleman for the Mediterranean by Messrs. Edwards & Symes, of London. Her length is 112 ft. over all, breadth, 16 ft. 4 in.; and depth of hold, 10 ft. 6 in.; and fitted by the builders with compound surface condensing engines of the highest class, and finish of 35-horse power nominal, she has been built under the highest class at Lloyd's, is fitted with a most unique steam windlass of special design, which does its work most efficiently. Amidships she has a handsome panelled polished teak deckhouse with a clear height of 7 ft. inside, above which is the bridge and steering gear. The cabin accommodation is on a scale most unusual for a yacht of her tonnage, the cabins and saloons being both large and lofty, panelled in polished pitch pine, mahogany, and teak, with brass and electro plated fittings, upholstered in utrecht velvet and cabin stores with Wilton tiles and polished brass mountings. She is fitted with three pole masts fore and aft, schooner rigged with awnings all fore and aft, and on the sea trial of two hours made an average speed of nearly 11 knots per hour, the machinery working most satisfactory and is the largest steam yacht that has been built on the Thames for some years, and is a credit to this enterprising firm, who have others building.

Foscolino.—On January 28th the new steamship *Foscolino*, the first built to the order of the Wear Steamship Company (Limited), managed by Messrs. R. Wrightson and Sayers, of the Exchange, Sunderland, ran a successful trial. The *Foscolino* was launched five weeks ago from the yard of Messrs. Pickersgill, Southwick, and she is 230 ft. in length, 31 ft. in breadth, 15 ft. 6 in. in depth, of 716 tons nett register, and has a carrying capacity of 1,400 tons, whilst the most improved machinery necessary for a cargo steamer has been provided. Her engines, which are on the compound surface-condensing principle, have cylinders of 27 in. and 50 in. diameter, with a 30-inch stroke, and during the trial ran 78 revolutions to the minute, developing 520-horse power, and a mean speed of 10 knots per hour.

Eleanor.—On January 30th, the London and North-Western Railway Company's new paddle steamer *Eleanor*, just completed by Messrs. Laird Brothers, Birkenhead, left the Mersey and proceeded to Holyhead to take her place on her station; and the run was considered as the official trial trip. There was a heavy sea on, and, the weather being hazy, the course steered was longer than it otherwise would have been; but, notwithstanding these disadvantages, the run from the Rock Light to the end of the Holyhead Breakwater was accomplished in three hours and 54 minutes, which gives a mean speed of 16 knots an hour. The engines worked splendidly, and developed about 1,850 indicated horse power, and the trial was considered highly satisfactory in all respects. The *Eleanor*, it may be mentioned, is the 500th vessel built and finished by Messrs. Laird, and the eighth built by them for the London and North-Western Railway Company, and, like the *Isabella*, *Lily*, and *Violet*, she is constructed of steel manufactured at the railway company's works at Crewe. Her dimensions are:—Length, 253 ft. 6 in.; beam, 31 ft.; depth in hold, 14 ft. 6 in., with a tonnage of 1,118 tons O.M. She is fitted with two distinct sets of compound oscillating engines, which can be worked either together for regular work, or immediately disconnected by steam gear and worked independently for manœuvring the vessel in difficult circumstances. The passenger accommodation is contained in a full poop, entirely shut off from that part of the deck where the cattle are stowed, and comprises a saloon about 45 feet long and the full width of the vessel. On the lower deck forward are comfortable second-class cabins and special accommodation for drovers. Fittings are provided for about 400 head of cattle, besides sheep, and special care has been devoted to the ventilation of the holds and 'tween decks.

Rydal Fell.—The screw steamer *Rydal Fell*, recently launched from the yard of Messrs Murdoch & Murray, Port Glasgow for the new Fell Line of steamships, went down the Clyde for her trial trip on February 1st. After having compasses adjusted in the Gareloch, she proceeded to the measured mile to test the working of the engines and speed of the vessel. The machinery, which was fitted on board by Messrs. Dunsmuir & Jackson, Govan, worked in every way to the satisfaction of the owners, Messrs. Hume, Smith & Co., The average speed attained was 11¼ knots per hour.

Ludgate Hill.—On February 2nd, this twin screw steamer, another of the large steel vessels recently built by Messrs. Dobie & Co., was taken down the Clyde upon the official trial trip. The dimensions of the *Ludgate Hill* are—420 ft. in length; 47 ft. in breadth; and 26½ ft. in depth; having a gross tonnage of 4,162 tons, and deadweight capacity of 5, 200 tons, with engines of 600-horse power nominal, supplied by Messrs. James Howden & Co., and the speed attained exceeded 14 knots. The appointments and outfit of the present steamer, like those which preceded her, are of the most substantial kind.

Afrikann.—On Feb. 10 a new steamer, named the *Afrikann*, for trade between Rotterdam and the West Coast of Africa, which has been built by Messrs. Raylton, Dixon, & Co., to the order of the New African Steamship Company, of Rotterdam, proceeded on her trial trip from the Middlesbrough Docks. She is built on the spar-deck rule, and is 225 ft. long between perpendiculars, by 31 ft. beam and 22 ft. depth of hold to spar deck, and will carry over 1,300 tons on 16 ft. draught. The has iron main deck laid with wood, cabin aft for captain and a few passengers, with accommodation under the bridge for her officers and engineers, and chart room and steam quartermaster for steering. Her engines, of 100 horse power nominal, by Messrs. Blair & Co., of Stockton, worked most satisfactorily, and all gave complete satisfaction to a small company of her owners, officers, and builders, who witnessed her trial trip.

Ahdeek. (*s*)—On February 14th, the screw steamer *Ahdeek*, launched from the yard of Messrs. Short Pallion. in December last, to the order of Messrs. Walker & Butchart, West Suniside, had a trial trip to sea, which proved of a highly satisfactory character. The dimensions of the *Ahdeek* are:—Length 245 ft.; breadth 34 ft. 6 in.; depth of hold 18 ft., 6 in.; deadweight carrying capacity, 2,050 tons; and she is classed in Lloyd's highest list, having been built under special survey. Intended for the general carrying trade, care has been taken to provide the most approved appliances for the purpose of navigation, or for the shipment and discharge of cargo, including four steam winches (one to each hold), Harfield's patent windlass, steel wire ropes, and Higginson's Quartermaster steam steering gear. After the compasses had been adjusted, a run was made to Marsden and back, for the purpose of testing the engines. These were supplied by the North-Eastern Marine Engine Company, and are on the compound surface condensing principle, Allan's patent, with cylinders 32 in. and 61 in. diameter and 36 in. stroke. During the trial they worked without a hitch maintaining a pressure of 79 lbs, vacuum 26½ in.; and performed 60 revolutions per minute, indicating 750-horse power. The log showed that fully 10 knots an hour had been attained.

Merton Hall.—On February 20th this vessel left Dundee to make her trial trip in the North Sea, and went as for as Aberdeen. Her machinery worked very satisfactorily. The average speed from the river to Aberdeen was 11½ knots per hour, and from the Bell Rock to the Bay of Tay her speed was 12 knots,

The *Canada*, one of the numerous corvettes of the *Comus* class, which was launched at Portsmouth on August 26th last, went out of harbour on February 15th, for a contractor's six hours' full power trial of her engines in the Solent. After one hour's steaming, the forward crank pin heated to such a degree that it was necessary to ease the engine down to dead slow, and put a stop to the trial. The engines were afterwards worked to half-speed for the purpose of testing the jet injection. The forward drop rudder was also tried, but in consequence of the trim of the ship, the value of the experiment was of the slightest. During the hour the ship was maintained at full power, a speed of over 14 knots was realised, while the horse power, indicated was 2,332·76, or 33 horses over the contract power. The *Canada*, went out of harbour again on Friday, February 17th, for a six hours' contractors' full-power trial of her engines. Captain Colomb, of the Steam Reserve, took command of the ship, while the machinery was watched on behalf of the Admiralty by Mr. John Oliver, the Steam Reserve being represented by Mr. J. H. Ellis, Chief Inspector of Machinery, and the Factory Department of the Dockyard by Mr. E. Newman, Chief Engineer. The forward draught of the ship was 14 ft. 2 in., and the after draught 17 ft. 8 in., giving a mean draught of 15 ft. 11 in. She was, therefore, very light as compared with her mean load draught, which is 17 ft. 9 in.; but she was brought down by means of iron ballast 3 ft. 6 in. by the stern, so as to give her screw the proper degree of immersion. The ship got under way at eight o'clock, but the first observations were not made until half-past nine, care being taken to work up the steam gradually to avoid all danger of hot bearings. At the end of the six honrs's continuous running the following means were obtained:—Steam in boilers, 58·33 lb.; vacumn, 27·5 in. forward and 27·1 in. aft; revolutions per minute, 104·94; mean pressure, 39·37 lb. in the high-pressure and 11·31 lb. in the low-pressure cylinders; total indicated horse-power, 2,432·73. This is very satisfactory, being in round numbers 133-horse power above the contract, without having had recourse to the blast. The speed realised, as tested by several runs on the measured mile, was 14,177 knots per hour. The *Canada* returned into harbour at the end of the trial, and will be completed for commission.

Athabasca.—This new steamer has been built by Messrs. M. Pearse & Co., Stockton-on-Tees, to the order of Messrs. Tapscott & Co., of Liverpool. This steamer has been constructed of extra strength, and built to the highest class in Lloyd's. The following are the dimensions:—Length between perpendiculars, 300 ft.; breadth of beam, 38 ft. 6 ins.; and depth of hold, 27 ft. 6 ins. Her total deadweight capacity is 3,300 tons. She has a forecastle, bridge, and poop. The bridge is carried to the afterside of the engine room to give extra protection to the engines and boilers in heavy weather; the bulwarks are 4 ft. high, which are left open opposite the hatches to allow the seas to run quickly off her decks. She is fitted with Donkins, Nichol, & Co.'s steam steering gear, and Dunlop, Bell, & Co.'s steam winches, and Suffield's patent volutical fresh water condenser. The old cat and fish davits have been done away with, and a single strong crane is made to take their place. This arrangement has given great satisfaction on the other steamers belonging to the same owners. The engines are constructed by Messrs. Blair & Co., Limited, of Stockton-on-Tees. The diameter of the cylinders are 38 in. by 71 in., and 45 in. stroke, with a boiler pressure of 80lbs. per square inch, the boilers are fitted with Fox's patent corrugated furnaces. The speed obtained on her run from the Tees to the Tyne, where she was taken to load, was 11 knots, the engines working very smoothly at the rate of 64 revolutions per minute under easy steam, and she proved a most satisfactory vessel in every respect, and gave great satisfaction to the owners and Mr. F. J. Pilcher, consulting engineer, of Liverpool, under whose superintendence the vessel was built.

Peter the Great,—On January 30th, the Russian turret-ship *Peter the Great*, which came to the Clyde a few months ago in order to be supplied with entirely new engines by Messrs. Elder & Co., of Glasgow, went down the Clyde on her first preliminary trial trip. She left the anchorage at noon, and returned shortly after four o'clock. Though not under full steam at any time during the trip, she succeeded in attaining an average speed of 12½ knots per hour.

The Douglas.—On February 15th, this steamer, launched some time ago by Messrs. Hall, Russell & Co., went out to the Aberdeen Bay for trial of speed, and gave very satisfactory results, attaining a speed of 13½ knots per hour, with the engines working very smoothly and indicating 1,425-horse power. *The Douglas* leaves Aberdeen direct for China in about two weeks.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 24th January 1882, to 20th February, 1882.

292 H. Lumley. Rudders.
333 P. B. Delany (communicated by T. J. Handyford). Electric cables.
356 J. McAdams (communicated by A. W. Reddie). Arresting progress of ships and other vessels,
358 C. A. McEvoy. Sounding apparatus.
361 H. A. Clark (communicated by W. R. Lake). Electrical cables.
400 C. Corneby. Propeller.
405 C. J. Ball. Improvements in dredging.
407 W. Fewster. Saving life at sea.
435 De Condé, Schmid, and Der Houx (communicated by H. E. Newton. Gun wads.
446 P. C. Sanderson and C. J. Fox (communicated by C. J. Fox). Cofferdams or sectional docks.
462 J. Turner. Tube stopper for boilers.
471 H. L. Williamson and J. L. Simnett. Steam boilers.
491 O. Jones. Machine guns.
494 G. L. Scott and H. Kenyon. Lubricants.
501 J. Rettie. Engine Governor.
502 A. Gibb. Marine Boilers.
512 T. Archer. Steering gear.
524 J. Jensen and C. W. King. Valve gear for engine.
564 H. P. Kirkham (communicated by H. H. Lake). Floating cofferdams.
593 T. Rowan. Transport and storage of coal.
603 G. C. Parini. Propellers.
628 T. R. Oswald. Twin screw vessels.
639 J. W. Wood & J. Greenwood. Economy of fuel in furnaces.
656 A. Brossard. Supply and cut-off for Marine Engines.
680 D. Ashton. Slide valves for steam engines.
682 J. Frotter. Apparatus for introducing anti-incrustation material into steam boilers.
691 S. Barlow. Fire bars and furnaces.
694 P. A. Nepilly (communicated by R. H. Brandon). Fire boxes.
710 J. McCammon. Controlling speed of engines.
713 A. Benast (communicated by W. R. Lake). Improved valve-cock.
719 J. Cooke. Apparatus for propelling and steering vessels.
723 G. B. Goodfellow and R. Matthews. Governing speed of steam engines.
727 A. Verey. Vertical steam boilers.
736 W. F. Johnston, A. K. Johnston, M. M. Johnston, and W A. Johnston (communicated by J. H. Johnson). Propelling torpedoes.
737 E. J. Mallett (communicated by J. H. Johnson). Boiler and other furnaces.
774 A. M. Jarriant (communicated by J. C. Mewburn). Protecting wires or cables.
776 G. A. P. H. Duncan. Marine engines.
780 D. Greig and M. Eyth. Brasses for connecting rod and similar objects.
787 W. H. Duncan. Guarding ships.
790 J. R. Wigham. Illuminating lighthouses.
793 A. Craven and G. J. Warburton. Condensers and air pumps of engines.
804 W. C. A. Holzapfel. Compositions for ships' bottoms.
806 J. Rapieff. Steam boilers.
811 J. Lumb. Lubricators.
813 E. J. Evans. Apparatus for disconnecting and connecting boats from and to ships,

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

January 28th, 1882.

Allan, Alex. J.	2 C	London.
Arthur, Thomas	2 C	Glasgow.
Balfour, Duncan	1 C	do.
Buley, John ...	2 C	London.
Button, John ...	1 C	do.
Crichton, Louis S.	1 C	N Shlds.
Duncan, Andw. B.	2 C	do.
Duncan, Wm.	2 C	Aberdn.
Economos, Grgry.	1 C	N Shlds,
Finlay, George	2 C	Glasgow.
Fleming, Jno. R.	2 C	do.
Fraser, Wm. G.	2 C	London.
George, Patk. M.	2 C	Aberdn.
Gregory, John	2 C	Dundee.
Greig, George ...	1 C	do.
Henderson, J. M.	1 C	do.
Ireland, Robert	2 C	Glasgow.
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Lewis, David ...	2 C	London.
Manning, Chas. S.	2 C	do.
Mowat, Robert	2 C	Glasgow.
McKinlay, John	2 C	do.
Mudd, Leonard	2 C	N Shlds.
Phin, Edward	2 C	Dundee.
Purnell, Fred ...	2 C	N Shlds.
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Shaw, Alex. ...	2 C	Aberdeen
Simmons, Geo.	1 C	London.
Stewart, John ...	2 C	Glasgow.
Wigmore, C. J.	2 C	N Shlds.

February 4th, 1882.

Anderson, Wm. J.	1 C	Bristol.
Balfour, Robt.	1 C	London.
Black, James ...	2 C	Lvrpool.
Corkhill, Wm.	E 1 C	do.
Hean, Peter ...	1 C	do.
Holdsworth, W. H.	2 C	do.
Lloyd, Wm. ...	1 C	London.
Luder, Henry R. C.	E 1 C	Lvrpool.
McGregor, Jno. H.	2 C	do.
McGregor, Wltr.	2 C	N Shlds.
McVie, Robert	2 C	Lvrpool.
Millar, David S.	2 C	London.
Parsonage, T. T.	2 C	Lvrpool.
Robertson, Thos.	2 C	N Shlds.
Rosney, Thos.	1 C	Lvrpool.
Rowson, F. S.	2 C	do.
Shields, Geo. ...	1 C	London.
Taylor, Wm. ...	2 C	N Shlds.
Thornton, H. ...	2 C	Lvrpool.
Wilks, Edwd. C.	1 C	London.
Williams, Jsph.	1 C	Lvrpool.

February 11th, 1882.

Adam, Matthew	2 C	Greenock
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Brown, John ...	1 C	Lvrpool.
Brown, William	2 C	Sndrlnd.
Christopher, D.	1 C	N Shlds.
Fowlis, John E.	2 C	Sndrlnd.
Gardiner, Thos.	2 C	Lvrpool.
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Gun, James Y.	2 C	Leith.
Hall, George ...	2 C	N Shlds.
Hartley, Willm.	2 C	Lvrpool.
Hislop, Dugald	1 C	do.
Huntley, Thos.	1 C	London.
Laird, John ...	2 C	Glasgow.
Leighton, James	2 C	Sndrlnd.

Macrae, H. F....	2 C	London.
Marshall, James	1 C	Leith.
Melville, Edgar	2 C	London.
Melville, James	2 C	Leith.
Milne, Alexndr.	2 C	do.
Moffitt, R. D....	1 C	Sndrlnd.
Newby, Chas. H.	1 C	N Shlds.
Nixon, Geo. C.	2 C	Sndrlnd.
Palmer, George	2 C	do.
Pronham, Chas.	1 C	do.
Robinson, B. M.	2 C	London.
Robson, Matt.	1 C	Sndrlnd.
Salter, Jos. H...	2 C	Lvrpool.
Simpson, Robt.	2 C	N Shlds.
Slater, James ...	1 C	Sndrlnd.
Smith, James ...	2 C	Leith.
Smith, Robt. ...	1 C	Sndrlnd.
Snowball, Hy.	1 C	do.
Suttor, John ...	2 C	Lvrpool.
Thompson, Jos.	1 C	N Shlds.
Tomlinson, T...	2 C	Sndrlnd.
Tyrell, William	1 C	Lvrpool.
Watson, Samuel	1 C	Grnock.

February 18th, 1882.

Aikman, J. M.	1 C	Lvrpool.
Anderson, J. G.	2 C	Glasgow.
Begg, Thomas..	1 C	Lvrpool.
Black, Robert...	2 C	Glasgow.
Charters, John	1 C	London.
Cooke, John ...	2 C	Glasgow.
Craig, John J....	1 C	N Shlds.
Crass, Thos. H.	1 C	do.
Cunningham, D.	2 C	do.
Davidson, Wm.	1 C	Glasgow,
Davison, John	2 C	Hull
Dodgson, Thy.	2 C	N Shlds.
Duncan, Robt.	2 C	do.
Elam, John L.	2 C	London.
Forsyth, Adw.	1 C	Glasgow.
Forte, Fredk....	1 C	N Shlds.
Garbutt, J. G. S.	2 C	do
Gibson, M. W.	2 C	do.
Henry, Rbt. A.	2 C	London.
Hildreth, Jas....	2 C	N Shlds,
Kendall, Jas. ...	2 C	Glasgow,
Lumsden, John	2 C	N Shlds.
Main, Robt. T.	2 C	do.
Mason, Alex. ...	2 C	London.
McComb, Arch.	2 C	Lvrpool.
McCreath, Thos.	2 C	do.
McDonald, Hy.	2 C	London.
McDowell, Dnl.	2 C	do.
McLachlan, C.D.	2 C	Glasgow.
Mitchell, John	2 C	Lvrpool.
Moses, Jas. J...	2 C	N Shlds.
Moss, Henry ...	1 C	London.
Munro, John F.	2 C	London.
Murchie, John	2 C	Glasgow.
Reid, William ..	1 C	N Shlds.
Scanian, H. E.	2 C	Hull.
Scott, James ...	1 C	N Shlds.
Sharlow, F. B.	2 C	London.
Shield, William	2 C	N Shlds.
Simpson, Geo.	1 C	Glasgow.
Stewart, James	2 C	do.
Story, Sentimus T....	2 C	N Shlds.
Trueman, Hy. C.	1 C	London.
Ward, Wm. H.	2 C	N Shlds.
Whitby, John...	2 C	Lvrpool.
West, Wm. J...	2 C	do.
Wilson, Thos. C.	1 C	Glasgow.
Woodhead, Jno.	1 C	Hull.

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The Marine Engineer.

LONDON, APRIL 1, 1882.

EDITORIAL NOTES.

THE ship railway, suggested by Captain Eads, over the Isthmus of Panama, has been allowed to sleep for a long time. It is, however, now being brought prominently forward in America, and money is being asked for its construction. Now that it has reached so practical a form it may be worth our while to give it some attention. There can be little doubt that if vessels can be successfully lifted by hydraulic power on to dry docks, as they are in Messrs. Stansfield & Clarke's dock, that a similar appliance can be used to lift vessels of any burthen on to a suitable cradle for land transit. The propulsion, then, of such a carriage on an inland railroad is only a question of sufficient propelling or hauling power, and a metalled road-way of requisite stability. So far, all is within the reach of modern engineering enterprise, though on a gigantic scale, and at enormous cost. The main difficulty will arise with the question of what should be the best form for the bearing or rolling surfaces of the carrying cradle. As a very average rule the weight of any carrying truck on railways is, at least, half that of the load, and a weight of 10 tons is about all that can be put on any pair of wheels and axle of the ordinary construction and on the usual road-way. To deal then with a vessel of only 4,000 tons, the carriage will weigh another 2,000 tons, and if carried on ordinary rails and axles would require to be distributed over 600 pairs of wheels. For driving power we may estimate that a heavy locomotive can only just take 200 tons up an incline of one in 100, which gradients Captain Eads expects to meet with. To deal with the vessel of 4,000 tons and carriage 30 heavy locomotives would be required. As many iron clads are much over 4,000 tons in weight, and the weight of ocean-going steamers are constantly on the increase, the foregoing figures are but a mild estimate of the difficulties to be encountered in such an enterprise.

WE see that the application of the Siren fog signals are to be very largely increased. They have been tested by the Admiralty, the Corporation of the Trinity House, and foreign Governments, at great expense during the last few years. The Siren is to be adopted in her Majesty's Royal Navy, and should prove of great value for giving signals from vessel to vessel in foggy weather. We see that a very good hot air or caloric engine has been used very extensively with Holme's Sirens for driving purposes. This engine, which is the invention of Mr. Buckett, though not much known in the outside market, has already been largely applied around our coasts compressing the air for fog signalling. This engine seems to be very economical in its work, requiring only 2½ lbs. of fuel per horse-power generated. The fire-place is closed hermetically, the air being forced in through the fuel. As the heated products of combustion from the coke are used direct, in moving the piston there is no chimney required. A pressure of 37 lbs., it is stated, can be maintained in the engine, and there is an entire absence of danger from fire or explosion. The supply of air is regulated by the action of the engine itself. We note that a large and influential company is being formed to manufacture and supply the Sirens to all navies and coasts, and to supply the Buckett hot air engines to the open market.

AGAIN is the question of the relative strength of the British Navy, as compared with those of the other countries, brought prominently forward for discussion. Lord Henry Gordon has embodied a series of speeches in the form of a pamphlet, entitled "Fore-warned, Fore-armed," in which this comparison of force is carried on as far as 1885. At present our number of iron clads are but little in excess of those of France, and in looking forward to the year 1885 the author of the pamphlet fears that England's present small supremacy will have disappeared. For ourselves, we think that these scares may be useful in keeping our attention to what we are doing towards keeping up our navy, and that it should be the best of its kind; but, at the same time, should war arise, we should always find some friend to swell our number of available ships, and if not, it is still quite an open question whether fast unarmoured cruisers with heavy guns, torpedoes, and great ramming power and speed, such as could be drawn at any time from our mercantile marine, would not go far to decide the command of the sea.

APPARENTLY, aerial voyages will soon become as popular as those on the more stable element, water. In spite of the lamentable accident which has so lately cast a shadow on aerial enterprise, we find that Colonel Burnaby has successfully accomplished a balloon voyage across the Channel. His experience has served to point out that much discrimination and coolness is required by the aeronaut to avail himself of those currents of wind which will drive him in the required direction. For instance, although Colonel Burnaby started with a wind favourable to his purpose, when he had almost attained the coast of France the wind veered round to south-south-west, and he began to drift back to sea. He, however, immediately rose to a higher altitude, and found there his original current which safely carried him over Normandy, where he descended without danger or difficulty. Mr. Coxwell and another independent party are both about to make similar trips to France. If these several excursionists prove that steady currents can be relied on at certain altitudes we shall probably find balloon voyaging to the Continent become a popular amusement.

APPARENTLY, Mr. Chamberlain's suggestion of the establishment of a Shipping Council is about to bear fruit. We see that the Newcastle Local Marine Board have adopted several resolutions upon the composition and powers of a Board, which they would recommend to the Board of Trade. The suggestions are these:—1. That the powers at present vested in the officers of the Board of Trade to stop unseaworthy ships and overloaded ships should be continued. 2. That the existing regulations as to the optional load-line marks should not be interfered with or altered. 3. That in all cases of detention of ships and steamers on the alleged ground of overloading or unseaworthiness, or from any cause, an immediate appeal should be made to the local shipping council, constituted as suggested in the sixth resolution. 4. That the shipping council for the Newcastle district shall include Hartlepool, Sunderland, North Shields, South Shields, Newcastle, and Berwick. 5. That the local marine boards of the suggested district should be reconstructed and made into a local shipping council. 6. That the local shipping council should consist of shipbuilders, engineers, legal gentlemen, and shipowners, and seafaring men; so many to be elected by the Board of Trade, and so many by the shipowners. 7. That a shipping council so constituted would be composed of the most competent men of the district, and their decisions in all matters of dispute between the officers of the Board of Trade and the shipowner could not fail to command the confidence of all parties. 8. That a local shipping council would afford a ready and inexpensive mode of settling all disputes as to unseaworthiness, overloading, or other alleged causes for detaining ships by the officers of the Board of Trade, and would put an end to the cruel, expensive, and oppressive litigation so justly complained of by the shipowners and the Board of Trade.

THE Americans are determined to carry out their project of carrying their mails in American bottoms. A Bill is being pressed through Congress, appropriating 25,000,000 dols., as a subsidy divided into ten equal annual instalments, and distributed as follows:—One-fifth to the Pacific Coast; two-fifths to Philadelphia and the ports of the north; and two-fifths to Baltimore and the ports of the south, including the Gulf. The subsidy is only to be given to ships owned, manned and built by Americans. They are to be of 4,000 tons, running at 18 knots; 3,000 tons, running at 14 knots; 2,000 tons, running at 13 knots; and 1,000 tons, running at 11 knots respectively. The English mails are to be carried at 18 knots, with a subsidy of 33 dols. per mile, half for each voyage, and the other services are 30 dols., 25 dols., and 20 dols. respectively. As this subsidy represents ten per cent. approximately on the costs of the ships, leaving entire receipts from freight and passenger traffic to cover expenses, it is a great catch for the American ship owners and builders, though evidently at the cost of the ratepayers.

LLOYD'S RULES AS AFFECTING MARINE BOILER CONSTRUCTION.[*]

By J. T. MILTON, Esq., Assistant Chief Engineer Surveyor to Lloyd's Register, Member.

April 30th.

AT a recent meeting of the Institution of Mechanical Engineers at Newcastle, a notable paper was read by Mr. F. C. Marshall on "The Progress of Marine Engineering," in which appears a statement to the effect that "the ordinary marine boiler, encumbered as it is by the regulations of the Board of Trade and of Lloyd's Committee, does not admit of much reduction in the weight of material or of water carried when working." Mr. Kirk, in the discussion which followed, remarked that "a locomotive boiler which is considered safe on a railway would not be passed for use in a steamer at the same pressure;" while, in replying on the discussion of the paper, Mr. Marshall explained that though he did not complain of the restrictions, "yet restrictions existed, and as long as they did exist they would have difficulty in modifying the form of marine boilers materially," and he endorced the remarks as to the locomotive boiler on shipboard. Such statements as these, coming from such well-known authorities, and so widely circulated as they have been, will in my opinion, tend to produce the erroneous impression in the minds of shipowners that Lloyd's Register is an obstructive institution, preventing them from obtaining all the advantages of high-steam pressure. In the present paper I shall endeavour to prove that this is not the case, by showing that the only restrictions imposed by Lloyd's Register are such as are actually demanded by considerations of safety. I would here venture to remark that the experience of the surveyors to Lloyd's Register, gained in the periodical examinations of marine boilers of all types, gives them exceptionally good opportunities of judging not only of the original strengths required for the structures to withstand the wear and tear to which they are subjected, but also of the defects of different modes of construction; as probably no persons in the kingdom have so many and such varied examples of marine boilers of all descriptions, of all ages, and in all stages of corrosion passing continually under their inspection. First, as to the restrictions regarding forms or types of boilers. Lloyd's Rules require any novelty in the construction of either boilers or machinery to be specially submitted to the Committee at as early a date as possible. The merits and demerits of each plan thus submitted are very carefully considered, and in very few cases indeed have the Committee of Lloyd's Register refused entirely to sanction any arrangement which has been proposed to be actually used. In every case of novel boilers in which it was evident that the original design or a modification of it fully provided for safety, unconditional approval has been given, whilst in many cases in which it is considered that the continued efficiency and safety of the boilers for long periods are dependent upon more than ordinary care and attention being bestowed upon them, they have been approved of, subject to their being frequently submitted to survey. I may mention that nine types of novel boilers have been passed unconditionally by Lloyd's Register, six types have been approved of, subject to frequent re-survey, while the Perkins' and Howard boilers are the only types which have been strongly objected to and disallowed. Of these novel boilers, those of the last-mentioned types have already been taken out of the s.s. *Wanderer* and *Howard* respectively, at the instance of their owners, and replaced by others of ordinary form; of the nine passed unconditionally, two have been taken out of the vessels in which they were fitted, and two have been materially modified, after a few months' trial, on account of their not giving economical results equal to the anticipations of their designers, not in either case on account of their having proved to be dangerous; of the five types of boiler approved of subject to frequent examinations, the results in every case have proved that the restrictions prescribed have been absolutely required, one type of boiler fitted in two coasting steamers having been found to have become somewhat damaged in the short space of three months between consecutive surveys; whilst two sets of similar boilers fitted in unclassed vessels making longer voyages, and therefore not subjected to the same amount of supervision, became absolutely dangerous, through their having been allowed to become dirty, and these have had to be removed. I think that this clearly shows that so far as *form* of boilers is concerned, any restrictions imposed by Lloyd's Register have not been uncalled for, while I think it will be conceded without question that on the subject of the use of mild steel for marine boilers coming to the front, the action taken by Lloyd's Register in approving of its use, on being satisfied of its quality, greatly facilitated its introduction. Next, with regard to the restrictions imposed by Lloyd's Register in the matter of strength. All structures must be made with a strength in excess of the load which they are designed to bear, in order to provide for their safety in the event of the occurrence of any or all of the following contingencies:—Latent defects or plans in the material. Errors or defects of workmanship. Exceptionally severe strains which may possibly be brought to bear upon the structures by causes other than those which they are designed to resist. The weakening effects of corrosion or wear and tear.

Upon the relative probabilities of the occurrence of these contingencies in different structures depends the excess of strength required in their design, the proper allowance for each of the causes being determined by actual experience. In the case of marine boilers, it is with the last-mentioned cause that we have principally to deal. As I have previously stated, the surveyors of Lloyd's Register possess exceptional advantages in observing the effects of corrosion, and this experience was brought to bear upon the subject at the time when the rules for the strengths of boilers were revised some three years ago. I have recently examined into the original scantlings of a large number of boilers made by eminent firms of marine engineers, and fitted on board vessels classed in Lloyd's Register just prior to the time when the officers of that Society commenced to survey machinery, confining my examination to the cases in which the boilers had not been built under Board of Trade supervision, and where the manufacturers were, therefore, to a large extent untrammelled and left free to carry out their own ideas on the subject of strength; and in every one of these cases the boilers would now be allowed by Lloyd's rules to work at a pressure, considerably above that for which they were designed. I find that on an average they would be allowed 25 per cent. greater pressure as regards the cylindrical shells, 44 per cent. greater pressure as regards the combustion chamber plating, 38 per cent. as regards stays, and 38 per cent. as regards furnaces, while in many cases the strengths far exceeded these averages. Of course, in regard to the surplus excesses of furnaces, and to some extent also in some cases in regard to the combustion chamber plates, it is difficult to work exactly down to any fixed rule, as an extra 1-32 on the thickness of the plate will increase the strength about 15 per cent.; but there is no such difficulty in regard to the shells, and this large margin shows that Lloyd's Rules in this case have not thrown obstructions on the previous practice, while the fact that the present rules are now worked down to by nearly all makers seems to show that, on the contrary, by inspiring confidence in less scantlings, they have really led the way for an increased pressure being carried by the same type of boiler to the extent of at least 25 per cent. That this confidence has not been misplaced is shown by the remarkable immunity from serious accidents of boilers which have been passed by Lloyd's Register; but, at the same time, I will endeavour to show that much, if any, further reduction of scantling would be imprudent, taking into account the deterioration to which all parts of boilers are liable.

First, let us take the case of cylindrical shells, the great thickness of which is the greatest obstacle at present to the carrying of increased pressures with the present type of boiler. Lloyd's Rules provide a different co-efficient of stress for boiler shell plates, according as the longitudinal seams are made with lap or butt-strapped joints, and as the rivet holes in these joints are drilled or punched, the co-efficients also varying with the thickness of the plate employed. Messrs. Parker & John some time ago carried out a series of experiments in order to determine the loss of strength of steel plates occasioned by punching the rivet holes without subsequently annealing the plate, and at the same time, in order to obtain comparative results in the case of iron, they made similar experiments with various thicknesses of iron plates. Their experiments showed, without doubt, that iron loses considerably in strength by punching, although to a less extent than steel; but we can scarcely assume that the loss of strength is less than 10 per cent., as in most cases it was found to be more than this. Lloyd's Rules provide for a stress of about 10 per cent. less being borne by punched plate than by the same plate in which the holes are drilled; at the same time, as experiments do not show that rivets are any stronger in drilled than in punched holes, the same stress is practically allowed upon them in each case by reducing the larger co-efficient of stress by 10 per cent. so far as the rivets are concerned for cases in which the holes are drilled. Practically, if boiler plate unpunched is credited with a strength of 20 tons per square inch, Lloyd's Rules credit the punched plates, and also the rivets either in punched or drilled holes, with a strength of 18 tons per square inch. Lloyd's

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[*] Read at the Twenty-third Session of the Institution of Naval Architects; the Right Hon. the Earl of RAVENSWORTH, President in the Chair.

Rules in new boilers made with lap joints allow a stress of 7,750 and 8,500 lbs. per square inch with thin plates, say 6-16 thick, according as the holes are punched or drilled, in 9-16 plates they allow 8,250 and 9,000 lbs., in 13-16 and thicker plates they allow 8,500 and 9,500 lbs. per square inch respectively. These figures, neglecting all possible imperfections of workmanship, and assuming a strength of plate of 18 and 20 tons per square inch respectively give a margin of strength of 5·2, 4·9, and 4·7 times respectively. If these plates become uniformly corroded to the extent of 1-16 of an inch, the same working pressure will produce stresses of about 9,300 lbs. and 10,200 lbs. per square inch in each case, the margin of strength being in all cases reduced to about 4·4 times, while a corrosion of 1-8 of an inch in the three cases reduces this margin to 3·5, 3·8, and 4·0, and a corrosion of 3-16 brings these numbers to 2·6, 3·3, and 3·6 respectively. This amount of corrosion is not an uncommon amount to be met with in boiler shells six or eight years old, and would so lessen the strength of the thinner plate as to demand a considerable reduction of the working pressure, while even in the thicker plate the margin of strength is less than many prudent engineers would care about working with, considering that these figures do not provide for any contingency as to defective material or workmanship. In shell plates fitted with double butt straps, if the straps are originally made somewhat thicker than the half of the thickness of the plates, a considerable uniform corrosion can take place without weakening the joint at all. For instance, suppose the butt straps are made ¾ the thickness of the plate, and the strength of the joint is made to be originally 75 per cent. of that of the solid plate, then a uniform corrosion to the extent of ¼ of the thickness of the plate, will reduce throughout to that of the riveted joint, so that the only loss of strength the structure would receive is that gained by the crossing of the joints—an amount which experiments have shown to be very small, with the wide plates now generally used. On the other hand, corrosion is often very far from uniform, and in the event of a leaky joint—a by no means unknown occurrence in the bottoms of boilers—the corrosion always found at neglected leaky places will attack the weakest place, the joint itself, and will really weaken the structure. Taking these points into consideration, Lloyd's Rules allow a greater stress with double butt strapped joints than with lap joints, although not so much greater as the uniform corrosion theory alone would justify.

Coming now to stays; the greatest stress allowed is 6,000 lbs. per square inch calculated from the smallest part of the stay, both with large and small stays; but when we consider that large stays are almost invariably made with raised threads and have the ends welded on, and that the strength of the welds cannot be relied upon to be equal to that of the rest of the bar, and also that the smaller screw stays have the threads left on them and are thus to some extent protected from corrosion, we see that a very appreciable amount of corrosion on each will be required to bring their strength to an equality. In flat plates supported by stays, and also in circular furnaces subjected to external pressure, we find a deal of difficulty in estimating the pressure which will produce a given amount of stress. In all the experiments on these joints with the results of which I am aquainted, the principal point observed has been the ultimate pressure producing rupture or collapse. In some only of the cases have the bulges and sets at the different pressures been carefully observed, while the critical pressure at which permanent set was first produced has in most, if not all, of the experiments on flat plates, to be estimated to be between two pressures, more or less widely apart, as the stages at which the observations were made were few or numerous. For instance, in some of a very extensive set of experiments made recently it is recorded that there was no set or bulge at 50 lbs., and 1-64th set at 100 lbs. in one case, while in another there is no set recorded at 200 lbs. and 1-32nd set at 300 lbs. pressure, the results thus giving no definite knowledge as to the exact proof pressure within 50 per cent. of the truth in the first case and 33 per cent. in the second. Experiments conducted in this way are nearly useless, as far as concerns any light they throw upon the elastic or useful strength of flat plates supported by stays.

Now in most structures the stress produced in any part is proportional to the load producing it, not only up to the elastic or proof stress, but also up to the ultimate strength of the material, so that an experiment giving the ultimate strength of the structure will also give a fair idea of its proof or elastic strength, if the ratio of the proof stress to the ultimate strength of the material is known. In the cases both of flat plates and furnaces, however, this does not hold good. With both, so soon as the proof strength is exceeded, the ratio of stress to load becomes widely different from what it was before. In the case of the flat plates, when a large amount of bulging has been produced by the pressure, the material is evidently wholly in a state of tension, whereas up to the proof strength the material must be in tension only where it becomes convex, and in compression where it becomes concave. The ultimate pressures such plates will bear are therefore, with ductile material, considerably more than double their proof pressures, being more proportional to the ductility or power of stretching than to the original stiffness or rigidity of the plates. Further, it is to be remarked that in all boilers, it is impossible to keep the plates exposed to the action of the heat of the furnace gases absolutely clean, and a very thin scale upon the water side of the plate is sufficient to offer such an obstruction to the flow of heat through it that the plate must become somewhat overheated, and when more than a very thin scale is allowed to accumulate, the plates must get very hot, and lose considerably in rigidity. This contingency has to be provided for, as well as the loss of strength due to corrosion. As a matter of fact, we find that very few, if any, old boilers have their chamber plates unbuckled, whilst, in very many comparatively new boilers, the plates are largely bulged through overheating alone, although they are found to be of their original thickness and to have a large margin of strength when cold. These considerations must not be lost sight of when comparing the pressures which are allowed in practice with the ultimate strengths found by experiments upon cold plates. Lloyd's Rules give a larger coefficient for ½ inch than for 7-16th plates, thus to some extent providing for corrosion, and they also give a greater coefficient for plates in which the stays are fitted with nuts than for those in which the heads are riveted, on account of the greater security afforded by the former method of securing the stays where buckling of the plates is to be apprehended. With regard to the Rules as they are at present for flat plates, I think I may safely say that they do not throw any serious obstacle in the way of working with a pressure of 200 lbs. per square inch, which largely exceeds any pressure that is either being used or contemplated at present, whilst experience gained with old boilers does not warrant any reduction of scantlings from those now required. In the cases of furnaces, we very much require some elaborate and costly experiments to determine the true law as to their actual strengths, the number of experiments made on full-sized furnaces up to the present being very small. Fairbairn's experiments were made principally on small models, and the rule he deduced, or modifications of it, have generally been used by engineers in designing flues, but, unfortunately, this rule does not well apply to the dimensions of furnaces usually adopted in marine boilers. For instance, it cannot be considered that a flue 7 ft. long and 3 ft. 6 in. diameter, made of ½-inch plates, would have its strength doubled by fitting an anti-collapsing ring at the middle of its length—a result which Fairbairn's Rule would lead one to suppose.

Recently, Mr. Fox, of Armley, Leeds, has made some experiments on flues about 7 ft. long and 3 ft. diameter, but as his experiments were made solely as a means of comparison of plain v. corrugated flues, various lengths and diameters were not necessary for his purpose, and were accordingly not used. In these experiments it is to be noted that all the plain flues collapsed at a much lower pressure than that deducible from Fairbairn's Rule, from their dimensions and thickness. Although there is such a lack of experiments giving the actual collapsing pressures of furnaces, we have an immense number of experiments of a negative character. The great number of actual furnaces at present running safely show that their collapsing pressure is at least greater than that at which they work, and thus prove that the rules by which they were designed provide at least sufficient strength for practical purposes, while not one of the many cases coming under my knowledge of actual collapse of furnaces at the ordinary working pressure has been due to constructive weakness. In some of the cases the cause has been clearly seen to be shortness of water, in others it has been the accumulation of lime-scale, in several others it has been the accumulation of a peculiarly tenacious scale, apparently principally composed of precipitated carbonate or sulphate of lime from the water, intimately mixed with mineral oil from the cylinders.

A very thin coating of this greasy deposit appears to be quite as non-conducting as a much thicker deposit of crystalline scale. Several collapses are traceable to a deposit of common salt, through allowing the density of the water in the boiler to gradually accumulate up to the saturation point; and in one at least of the two or three cases in which the furnaces have lately collapsed, but have been found to be perfectly clean on the vessel's arrival in port, this accumulation of salt has been the cause of the accident, but the engineers have, by freshening the water after the accident, dissolved the deposit. All these cases come under the category of overheating, not of structural weakness, for although the use to which furnaces are put necessitates their being raised to a temperature somewhat above that of the steam, and therefore requires their being made thicker than would suffice to withstand the working pressure if they were always cold, yet no thickness of plate whatever will give sufficient rigidity at a red heat to prevent such accidents if they are subjected to such conditions.

In investigating the strength of furnaces, and in deciding upon what margin of strength is necessary to provide for safety, it must be remembered that, unlike most other structures, their proof strength is also their ultimate strength. Up to their proof strength the material is subjected to simple compression, but so soon as this is reached, deformation commences, and the material then fails, by cross bending, at a much lower pressure than it stood before alteration of form. In fact, a slight deformation produces such a considerable loss of strength in a tube subjected to external pressure, that it appears that the important factor to be ascertained in any flue of given diameter and thickness is not so much its length, as its roundness. Lloyd's Rules for furnaces are a modification of Fairbairn's Rule, with a limit as to the effect of short lengths; they do not take into account the form of the joint of the plates, whether welded, lapped, or butt-strapped, or whether the rivet holes are punched or drilled, as careful measurements of a great number of furnaces, as actually made, show that the roundness, or rather the want of roundness, in practice does not depend upon the joint at all, but depends upon the care bestowed on the workmanship, the roundest furnaces being often found to be those with lap joints, while welded flues are often far from cylindrical. If further experiments are made upon the strength of flues, I do not think that they can very much affect the existing pressures carried by furnaces of the proportions at present used, but if the Rules for furnaces do bear hardly upon engineers, I feel sure that, if they will prove by actual experiment, as Mr. Fox did with his corrugated flues, that any modification of them will provide for safety, making due allowances for the weakening by corrosion and other contingencies, the Committee of Lloyd's Register would not be found to raise obstructive objections. With regard to the statements I quoted at the commencement of this paper as to the use of locomotive boilers for marine purposes, I would wish to remark that the conditions under which marine and locomotive boilers are widely different. Locomotive boilers may be kept under constant skilled supervision, while marine boilers are often away on voyages of many months' duration. Locomotives, again, not being fed with sea water, do not in general suffer so much from corrosion, nor from the accumulation of non-coneducting scale as marine boilers, and therefore they do not requir- at first such a large margin of strength beyond the working pressure; but I think it very doubtful if *old* locomotive boilers are allowed to run with less margin of strength than *old* marine boilers, before they have their pressure reduced or are broken up, and it is at this stage of their existence, if at all, that their relative strengths should be compared. At the present time, while many engineers are looking to the locomotive type of boiler as offering some advantages in point of weight over the marine boiler as at present in use, it may be interesting to know that one of the boilers passed unconditionally by Lloyd's Register was of the locomotive type, but its performance during the first voyage of the vessel was so unsatisfactory that the owner ordered another boiler of ordinary type to replace it, and it was taken out of the vessel after about six months' work. In this boiler, even after three months' work, the sides of the fire-boxes commenced to bulge between the stays, although they were kept as clean as it is possible to keep marine boilers, and the water spaces were thought to be ample, being six inches wide at the lowest part, the circulation of water in these spaces also being supplemented by external circulating pipes. The flat-sided fire-box does not seem, from this, to be well suited for marine boilers, and further experience with this and with other novel boilers has shown that when the fire-door is open, the cold air rushing in direct to the tubes contracts them at the ends, and causes them to leak; whereas, in the ordinary boiler this air has to pass close over the fire before reaching the tubes, and consequently gets heated and does not do so much mischief. Up to the present time, I believe that the reason why the ordinary type of boiler is almost invariably applied for marine purposes is not on account of any restrictions imposed upon new types by Lloyd's Register or by any other controlling body, but solely because the great difficulties of designing a marine boiler which shall meet all practical requirements better than those of ordinary type have been greater than the inventive genius of our marine engineers has been able to overcome. In conclusion, let me say that I feel sure if marine engineers will design and submit any improved boiler to the Committee of Lloyd's Register, it will have very careful consideration, with a view to encouraging any *safe* advance, but *safety* must be the first consideration.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE 22nd annual meeting of the members and associates of this Institution was held at the Hall of the Society of Arts, John Street, Adelphi, on the 29th, 30th and 31st ult., for the purpose of hearing papers read on subjects of a novel character affecting modern ship-designing, construction, &c., and discussing the merits and demerits of the same. Notwithstanding the fact that naval architecture is one of our leading industries and that British shipbuilders command a large monopoly of the shipbuilding contracts for every nation on the face of the globe, this Institution does not class on its roll of members and associates one fifth of the number of those engaged in naval and marine architecture which might be anticipated considering the combination existing amongst many very minor industries, and the numbers, that support their respective institutions or societies. On March 1st, 1860, the first session was opened by the Rt. Hon. Sir John Pakington, G.C.B., D.C.L., &c.; at this time the members and associates numbered 324. After the lapse of 22 years this number, which was a very promising one to commence with, has not been doubled. It is difficult to understand the cause of such a state of things without presuming that naval architects and shipbuilders generally are less inclined to combine for the furtherance of knowledge and protection than other professions and trades. At the same time it is a glaring fact that the contributions to the volumes of the Transaction of this Institution are worked out and compiled to a great extent by a few members who take a deep interest in its progress and welfare, the bulk of the members and associates being content to remain neutral, and allow the working part to be borne by whoever may choose to do it. As an example of this may be noted the fact that Mr. N. Barnaby, C.B., Director of Naval Construction, Mr. J. Scott Russell, and Dr. Woolley, L.L.D., &c., who were each represented by high class papers at the first meeting of the Institution are still on the active list. Since the opening session Mr. N. Barnaby has read 13 papers, Mr. J. Scott Russell 20, and Dr. Woolley 6. Other prominent contributors are F. K. Barnes 6 papers, Mr. Crossland 2, Mr. Denny 3, the late Mr. Froude 17, the late J. Grantham 8, Mr. W. John 7, Mr. B. Martell 5, Mr. C. W. Merrifield 17, the late Mr. Rankine 17, Sir E. J. Reed 12, Mr. W. W. Rundell 7, Mr. J. D. A. Samuda 4, & Mr. W. H. White 7, Mr. W. Denny, Mr. W. Parker, Mr. J. H. Biles and Mr. A. C. Kirk have also been frequent contributors of late years.

Besides these Admiral Sir E. Belcher, Admiral E. P. Halsted, Admiral Paris, Admiral Sir Spencer Robinson, and Admiral J. Selwyn were frequent contributors of various papers.

All the above named gentlemen, independent of matter worked out and supplied by them to the Transactions of the Institution, continually took an active part in the discussions on subjects brought before the Institution, thus adding great interest and value to be recorded in the various annuals.

It will be understood from the foregoing description that a large amount of work has been borne by a few, reflecting the greatest credit on their application and self denial, especially as the gentlemen referred to were all engaged in the duties of every day business of a more or less arduous nature. There has been many casual contributors of papers of great merit, but considering the average number of members and associates on the roll of this Institution during the 22 years of its existence it cannot be denied that a great want of interest in its proceedings has been displayed by the majority. Amongst many belonging to this Institution, who never or if ever very rarely attend its meetings, a dissatisfied feeling is expressed to the effect that the days annually devoted to the reading and discussing of papers are monoplized by a few and that it would be useless for an outsider to submit a paper for the approval of the Council. If those who imagine this to be the case would come forward with some matter of interest they would doubtless find the workers who have borne the heat and burden of many sessions pleased to rest and listen to the productions of others.

The annual meeting which has just drawn to a close fully proves the fact that a great majority of the readers of papers may be termed permanent contributors. Mr. J. D. A. Samuda, Mr. W. Parker, Mr. W. H. White, Mr. W. W Rundell and Mr. B. Martell contribute 1 paper each, whilst Mr. A. C. Kirk, Mr. W. Denny, and Mr. J. H. Biles each contribute 2 papers.

All of the above mentioned are well known readers of papers and may be regularly expected to come forward year after year. The fact that although this Institution consisting of over 600 members and associates only meet once a year, and that three members each supply two papers to fill up the three days' programme is enough in itself to prove the want of life and interest concerning their own affairs that exists at present amongst those belonging to this Institution.

FITTERS IN THE ROYAL DOCKYARDS.

IN the House of Commons Mr. Broadhurst brought before the House the grievance of the Navy fitters. Mr. Broadhurst said he had no intention of attributing blame to either the present or the late Government in the strictures which he was about to pass on the system which prevailed. The Government was not responsible; the system was to blame. The burden of his contention was that it was impossible for men not highly trained and skilled in the working of iron and in the management of machinery to do their work as fitters satisfactorily. The shipwrights, both in the Royal and in private dockyards, could hold their own against the world as workers in wood. But it was not reasonable to expect those men to be able to turn their hands from the labour of their lives to learn a new business. That was precisely his complaint. The system of employing shipwrights who were workers in wood as fitters in ironships was not a new one, but had existed for twenty-five years, and had even since that time been extended. In 1877 all machinery of all kinds was fitted by these men. By a regulation of that year all machinery was handed over to the fitters, except that which was required for the propulsion of the vessel. All work connected with cranes, winches, and capstans, whether worked by steam, hydraulic, or air power, instead of being, as it had formerly been, in the engineers' department, was transferred to the shipwrights' department. The chief engineer in authority was connected with the engines and boilers, and had no control over the shipwrights, so that the result was that there was no undivided authority, and in case of accident no one was liable. He wished the House clearly to understand that the men whom he had been describing were unable to make a single inch of the delicate and complicated machinery over which they had control. No private contractor would act on the system followed by the Government, and in all private dockyards great care was exercised that the men employed as fitters should thoroughly understand the machinery which they were handling. Those who had the management of affairs in the Royal Dockyards were officials of position and character, who doubtless, intended to do what was right, and this extraordinary proceeding was the result of drifting as it were. He understood that the present Board of Construction consisted of five shipwrights, one engineer, one engineer's assistant, one engineer-in-chief, and a secretary, who was also a shipwright. Here there was a preponderance of shipwrights in the proportion of something like three to one. He would now give some illustrations of the extraordinary work to which he had been referring. On board the *Inflexible*, which was being fitted at Portsmouth, an important electrical machine, intended for the instantaneous transmission of messages from one part of the vessel to the other, was fitted by shipwrights to the inequalities of the deck in such a manner that it would not work at all. No engineer trained to the fitting of engines would ever have made a fatal and an almost criminal mistake of that kind. Again, on the *Agamemnon* two water-tight doors, on which the safety of the ship might in certain circumstances depend, were fitted by shipwrights in such a way that they would not shut, and, therefore, were of no use. On board the *Polyphemus* several doors and valves, which had been originally fixed by shipwrights, had to be redone by fitters. With regard to this keel ballast, on which the safety of the vessel so much depended, it was most important that the machinery for letting it go and tightening it up should be the best that could be got, and fitted into its place by the best possible mechanics. Then there was another matter connected with this extraordinary vessel which he wished to bring under the notice of the House. He had been informed on good authority that the capstans after having been made by contractors were fitted on board by shipwrights, but, in consequence of their getting out of gear, the shipwrights sent for the dockyard engineer, who declined to act in the matter, whereupon the shipwrights had to repair the defects themselves. The result was that it took 35 lb. of steam to work the capstans when they were light, whereas, when at full work, they ought not to take more than 10 lb. But there were other instances of defective work on board this vessel. Owing to the unsuitable machinery, employed, the launching of the raft occupied from twenty to thirty minutes instead of two or three, as it ought to do. Then it appeared that at Sheerness Dockyard it was the custom for shipwrights, instead of ironworkers, to fit the iron water-tight compartments in vessels. Then, on board the *Inflexible*, the shipwrights had made four attempts to erect some important hoisting machinery but having failed in their efforts, owing to their want of engineering knowledge, engineers were at last called in to do the work. Again, ridiculous designs for rudder-heads having been made by the shipwrights' department, it was ultimately found necessary to have other designs prepared by an engineer. Upon the arrival of the *Ajax* at Chatham, after her completion, it was found that her two ponderous turrets, which had been fitted by shipwrights, would not work, and had to be lifted up from the deck altogether. This was owing to a mistake made by the shipwrights in erecting them, and he had been informed by persons of the highest experience that this mistake would cost the country at least £5,000 or £7,000, to say nothing of the trouble, loss of time, and want of confidence caused to those on board. The statements he had made were based on careful investigations extending over the past twelve months, and the facts he had stated constituted but a mere scrap of the many fatal extravagances, blunders, and waste of money that prevailed in the dockyards through men being employed upon work they did not understand. Shipwrights accustomed to build only wooden vessels were now employed as platers, engineers, iron-fitters, &c., without any inquiry as to whether they were capable of doing such work. At Devonport, for instance, shipwrights were put to bend a stern plate to one of the vessels lying in the dockyard, but being unable to manage the job it had to be handed over to the engineers. Then the shipwrights were asked to give an estimate for an iron coal shoot, when they fixed £20. The iron shipbuilders, knowing more about the matter, fixed £30. The work was then intrusted to the shipwrights with the result that it cost the country £50. The fact was that many of the shipwrights were supernumeraries, and in order to find them employment they were put upon work to which they were unaccustomed. Although our present ships were almost entirely constructed of steel and iron, 200 shipwrights had entered the Dockyards at Portsmouth as against twelve fitters. It had been said that it was more convenient to employ shipwrights who went on the establishment than fitters who did not care to do so. What was the reason of that? Some years ago a proposal was made to the fitters with a view to induce them to enter the establishment. The proposal contained a provision reducing a wage of £1 14s. a week to £1 10s., and so on in proportion, and offering a speculative pension as an off-set for the reduction. The Government could not be surprised at the refusal of the fitters to accept those terms. He complained also of the way in which work such as patterns made by the chief engineer were submitted to the inspection of the shipwright, a worker in wood, and when he had approved them, instead of their being executed in the yard, where men and materials were lying idle, they were put out on contract, for no reason that he could conceive, except that the Dockyard officials had the purse of the nation to dip into. The Government work might often be executed within the yard when it was sent out. And it was of the utmost importance that every part of the vessels should be perfect. He did not wish the House to imagine that he was actuated by any undue sympathy with trades unionists in his remarks. In these matters the trades unions were perfectly patriotic and disinterested. But these new vessels were, to a large extent, experiments. The slightest flaw in the machinery of any part was fatal to the efficiency of the whole vessel. It was, therefore, most important that the machinery should be fitted by those who had the training and experience necessary to render them capable of doing it well. He begged to move:—

"That in the opinion of this House it is detrimental to the public service, fatal to the efficiency of our war ships, and unjust to the artificers concerned, that superintending leading men should be placed in authority over workmen, with whose trades they have no practical acquaintance, or that men should be put to execute work for which they are unsuited either by training or experience."

Mr. Slagg, in seconding the motion, said that all his hon. friend asked was that the best qualified workmen should be charged with duties which they only were capable of properly performing. It might be questioned, judging from the instances that had been adduced, whether the officials of the Navy fully recognized the enormous changes that modern science had necessitated in the structure and management of vessels; though no educated men could have wholly failed to notice the fact that science in its most refined and abstruse applications had revolutionized naval warfare. If the statement of his hon. friend was to be accepted, our dockyard authorities must have been very slow to make themselves acquainted with recent material and mechanical progress. In the present day totally new accomplishments were necesssary for the chief officers and a totally new training for the men under them. The training that was sufficient 50 years ago was now altogether inadequate, so that the sailor of to-day became efficient much less speedily than his predecessor. He agreed with his hon. friend that the line of demarcation was not strong enough between engineers and the men who, with inferior positions, were set to do engineers work. It was doubtful where the engineer ended and the shipwright began. And when men did work for which none but trained engineers' were fit, it seemed to him that the case of his hon. friend was made out, or at least the Government might be asked to look into the matter. They brought no charge against the Government, but wished simply to bring some little pressure to bear upon them to help them if possible to escape from the bonds of red tape.

Mr. Trevelyan said that his hon. friend, speaking with great special knowledge and personal conviction, had brought forward a motion the terms of which showed that there were in his mind certain doubts which he was very glad to have so fair and full an opportunity of clearing up. The subject of his resolution was an important one and a very delicate one. He himself was speaking to-night not only as a member of the House and a member of the Government, but as the representative of a firm employing vast quantities of labour in different parts of the kingdom on matters closely affecting the interests and feelings of the workmen whom they employed. Everyone knew how cautiously, in the private trade, an employer would, under those circumstances, open his mouth in public, and he must, therefore, be excused for a little reticence, though he would promise to be sufficiently explicit. The state of the case was this. A generation back, when ships were built of wood and not of iron, the great bulk of the skilled mechanics in the dockyards went by the name of shipwrights, and were, as a matter of fact, carpenters specially skilled in a special class of work. The master shipwright had under him a certain proportion of fitters and millwrights, for the purpose of carrying out certain metal work in connection with the hulls of ships, but the great army of skilled workmen were the shipwrights. They might, indeed, well be called an army, because they had some of the best military qualities about them. They regarded the nation as something more than a mere paymaster; they were proud of their position; they valued their certain and assured employment, and a prospect of a pension in their old age. The hired men who were not yet established looked forward, by good behaviour and ability, to succeed to vacancies on the establishment, and to become entitled to a pension. And their appreciation of these advantages they showed by serving for a much lower pay than shipwrights received in the private yards; and 30 years ago shipwrights took, and took without grumbling, at Woolwich and Deptford, 4s. a day, when workmen in the private yards on the Thames were earning 7s. Well, the nature of shipbuilding had since then entirely changed, and the mechanical powers and faculties of the shipwrights had changed with it. Thirty years was a very long period in a generation of working men, and the men now in the yards, who were classed as shipwrights, had been trained mainly from boyhood upwards—for we had at all times 545 shipwright apprentices engaged in learning their trade—in metal and not in wood. Their name had not been changed, but they were doing work as different from that which was done by the shipwrights of 1851 as the work of making a locomotive was from the work of making a mail coach. But in one respect they had not changed, and that was in their relations to the nation which employed them. They still preferred the certainty of the establishment. They appreciated being Government workmen, with a right to pension. And the Government encouraged them in that view, because, to speak quite plainly, it was a matter of life and death to the country to have in the crisis of a war a great body of skilled workmen, on whose services the nation might count, as it counted on the services of its blue jackets and marines. To what a great extent that might be said of the shipwrights was shown by the fact that of 4,200 shipwrights nearly 3,000 were actually on the establishment, a fact the value of which, under circumstances that had occurred before and might well occur again, it was hardly possible to overrate. Now, the fitters viewed the question differently. The certainty of employment, the short hours—for our dockyards only worked 51 hours in the work—had not, as a general rule, attractions enough in their eyes to make them surrender high wages for the privilege of being on the establishment. Out of nearly 1,300 fitters there were only 236 on the establishment, and the wages which they received were higher by 9d. a day than those received by shipwrights, either hired or established. The fitters, speaking through his hon. friend, told them that they did not like to see work which they could do done (and, as they maintained, not well done) by men who did not belong to their branch of the trade. Their contention was that the shipwrights were mere carpenters. A deputation of fitters waited on the hon. member for Rochester, and stated that the authorities had given fitters' work to shipwrights:—"Men who are used to wood-work and know nothing whatever of fitting." Especially (they said) that was the case with the fitting of doors in water-tight compartments. "The ironclads of the present day," they urged, "cost between £500,000 and £600,000, and if an accident took place from bad workmanship the ship would be at the bottom of the sea with 200 or 300 sailors. The fitters had stood this as long as they could, until they found the very bread was being taken away from them and given to others not entitled to the same." But when the shipwrights heard of the movement among the fitters they, too, were on the alert; they, too, addressed the hon. member for Rochester, and described themselves as follows:—"We are the working constructors of the British Navy in wood, iron, and steel, and at the same time principally in steel. Therefore, who can be so capable of fitting doors of all kinds, sluice valves, armour plates, stems, stern-posts, rudders, and all else pertaining to the construction of a ship of war as the shipwright?" They, too, stated that a ship of war costs £700,000 or £800,000, and that the lives of 500 or 600 men depended upon the workmanship in it. And they urged these considerations with the warmth of men who felt that their bread and the bread of their children depended on the issue of the controversy. Now, these allegations having been made on both sides, and the consequences to the individual fitters employed in Her Majesty's dockyards being nothing (for under any circumstances there was no talk of discharging them), while the consequence to the shipwrights would be very serious indeed, he hoped that the House, in fairness, would allow the shipwrights to be judged by the opinion of those who had an intimate knowledge of the work which they turned out. The opinion of the Constructive Department of the Navy fully and absolutely confirmed their contention that in technical skill the fitter and the shipwright who worked in iron were on an equality. The late Controller, Sir Houston Stewart, summed up the unanimous feeling of the department over which he so long and so ably presided when he said, "the shipwrights have become skilled workmen in wood and iron, thus enabling a great deal of the work which in former days could only have been done by fitters to be skilfully turned out by them at lower wages than fitters receive." Captain Parkins, of Pembroke Dockyard, assured him that a very large number of the shipwrights had ceased altogether to be carpenters, and were skilled workmen in iron and nothing else. That was the opinion inside. What was the opinion from without? Mr. Henry Laird, of the Birkenhead Ironworks, unsurpassed as a judge, and perhaps, unsurpassed in his experience of Admiralty work—Mr. Laird, fresh from a complete overhauling of the ironclad *Hotspur*, which had been built by shipwrights, said of himself and his partners, "we always consider that the work turned out by the Royal Dockyards is of superior quality, and have found such as has come under our immediate observation thoroughly sound and good." Mr. Peter Rolt, the representative of the Thames Ironworks and Shipbuilding Company, wrote as follows:—"I beg to state that, from my long acquaintance with work in the dockyards, I have no hesitation in pronouncing the work on ships to be of the very best description." There they had outside opinion in this country. What was the opinion abroad? In 1873 and 1874, when it was contemplated to introduce iron shipbuilding on an extended scale into the French dockyards, some eminent constructors were sent over to examine and study the system pursued and the work turned out in our dockyards, and their reports were so favourable that our system of having a foreman of the class of naval architects over each ship, with a special class of shipwrights bred in the dockyard, was generally adopted in the construction of modern iron ships in the French Navy. That able writer and excellent judge, Engineer King, of the United States, made similar observations in his official report. "The inferior officers and workmen," he said, "in the English dockyards are employed solely on their merits, and are mainly well-trained, efficient, and faithful, besides which the permanence of employment adds stability and gives character to the whole staff of employes." And, finally, the work of our shipwrights was submitted to an ordeal through which nothing could pass which was not sound and true. It had to find favour in the eyes of the captain and the officers of the vessel, and that was no slight test of its excellence, as would be acknowledged by anyone who had seen the commanders of such ship as the *Nelson* and the *Inflexible* hanging about the lobbies and office rooms of the Admiralty day after day to ask, not for some advantage of pay or rank for themselves, but for some more and more exquisite perfection in the safety and fighting power of that beloved vessel over which they thought that the nation should be only too proud to spend its money. The *Inflexible* was not in favour in some quarters, but Captain Fisher who understood his vessel, had sent a letter to the Admiralty saying that in all its complicated arrangements, it fully answered the anticipations he had formed. If this motion were carried, they would be forced to break int their system—to discharge the men by hundreds; and why How did this controversy begin? He would read a letter writt by Admiral Brandreth at the time that he was superintendent at Chatham :—"The fitter question refers to an arrangement we made here some months since. Fitters' work has been in arrear from the ships"—the *Agamemnon*, the *Ajax*, and the *Polyphemus*, no doubt—"all getting into thefitting stage at once, while the shipwright's work was well ahead. So, as the wages vote would not allow more fitters to be entered, an arrangement was made to remove the ship-branch fitters from on board and work them at the machines and shops, in order to prepare additional fittings, which additional fittings shipwrights have been employed to fit on board. This has been found to help the work much, and has prevented the discharge of shipwrights." Now, he would ask hon. members to consider what, if this motion were passed in its present shape, they would be doing. Here was a little shipbuilding crisis, resembling on a very small scale what would occur in war. In order to push on the arrears of work, that excellent manager, Admiral Brandreth, judged that he wanted more of the men in the shops and fewer in the ships, and, therefore, for the first time in the history of our dockyards, Parliament was invited to step in and remove from the Admiral and the Captain superintendents the discretion of arranging the national work as in their judgment they thought best. There was really no foundation for the cry of taking bread out of the fitters' mouths. On this very occasion twenty more fitters were entered at Chatham yard, so far from any being discharged; and the Constructor told the men, with perfect truth, that, if it had been the shipwright's work that had been behind, and the fitters' work had been ahead, he should have made a precisely counter-arrangement in order to avoid a discharge of fitters. He had hitherto spoken with reference to the class of work on which fitters and shipwrights were employed. He should now wish to say a few words on that part of the resolution which related to superintendence of labour. The case stood thus :—In the steam branch of each of our dockyards all the skilled workmen were fitters, all the leading men fitters, and the foreman of the branch was invariably an engineer likewise. In the ship-fitters' shop, where ironwork was made destined to be put on board-ship, the leading men were likewise ship-fitters. He believed it was nowhere the case that fitters, as a body, were under the authority of leading men not of their own trade. But on board ships in process of construction the foreman in charge of the ship was a shipbuilding officer. The essence of the English system was that one and the same foreman, who was, in truth, a naval architect, was responsible for the progress of one and the same ship, just as on land one and the same architect superintended the construction of a building, whether built mainly by bricklayers or joiners; and the Admiralty could not consent that the responsibility for the construction of the ship should be divided between as many foremen as there were men of different trades employed on board, any more than in building a house one architect would be told off for the joiners and another for the bricklayers. The foreman was an officer highly paid, of great importance, and very great scientific knowledge—an officer of an education and standing very much above that which his name might in the ears of the general public imply. Hitherto these foremen of the yard, who had both shipwrights and ship-fitters under them, had been taken originally from the shipwright class; but he was perfectly prepared to say that the Admiralty, who were now on the eve of examining into the organization of the constructive department, were ready carefully to consider whether promising men of the engineer class might not have a chance with others of qualifying themselves for the arduous duties of general foreman of the yard. To what extent the naval constructors of the future were to be taken from a class of special officers educated for the purpose was not yet determined; but, so far as they were drawn from the ranks of the workmen, shipwrights and fitters ought to have an equal chance in proportion to their numbers of being educated for the posts of foremen and constructors. To show the tendency of thought in the Admiralty with regard to this question, it was only last week that he had in his hand papers carefully discussing the circumstances under which fitter apprentices were to share with shipwright apprentices, the advantages of being educated at the Naval College at Greenwich. He thought the House would see that this reform would remove every vestige of the complaint which his hon. friend made with regard to the class of fitters not having their fair share of authority. He might say that both with regard to the class from whom our naval constructors were to be drawn, and still more with regard to the distribution of work between shipwrights and fitters, the Admiralty expected great assistance from the advice of Mr. Rendel, the new Civil Lord, who had had unsurpassed experience in dealing with great bodies of workmen in steel and iron. In the interests not only of the public service, but of the men themselves, it was vital that our dockyard management should not be bound by hard-and-fast rules. In shipbuilding, and, most of all, in shipbuilding for war purposes, it was unavoidable that ships should be in various uneven stages of advancement, and at one time, an enormous amount of one kind of work had to be done and a few months afterwards the pressure was in the direction of quite a different class of work. Now, in private establishments, in order to meet the exigencies of trades-union rules, the redundant men of one class would be discharged, and men of the class required would be entered, and they, in their turn, would again be discharged and give place to others. But in the national dockyards it was not desirable, and anyhow it was practicably impossible to play fast and loose in this style with the vast masses of workmen whom they employed, depriving them by hundreds a day of the right to a pension which they had been many years in earning, and therefore it was that our constructors were allowed to shift men from shop to ship and from ship to shop, whether they were called fitters or shipwrights, as long as they were good workmen able to perform the task on which they were engaged. That power, essential, as he believed, to the national welfare, essential. as he was sure, to the comfort and final well being of the workmen whom they employed, they must not abandon without greater reason than his hon. friend had shown. There had been a system of reporting instances, or supposed instances, of bad workmanship on the part of shipwrights. If ever one case out of many had something in it the constructors said that, if they chose, they could provide him with equivalent cases of bad workmanship on the part of the fitters. But, with their full and hearty approval, he had agreed to have nothing to do with this line of defence. The Admiralty would not run the risk of fostering a rivalry between two great classes of public servants which, novelty as it was, might soon grow into a positive danger to the State. The Admiralty would not run the risk of encouraging one set of workmen to be ever on the alert to detect imperfections in the work of another set of workman. Fitters and shipwrights had for many years wrought side by side as brother workmen, and he earnestly trusted that the effect of that debate would be to clear up the feeling which last summer was for the first time visible, and which he could not help hoping that second thoughts had to a certain extent already mitigated. The question had received the attention of the Admiralty ever since his hon. friend had had his notice on the paper, and everything should be done which considerations of the national advantage would permit to see fair play between all classes of our public workmen.

After a few words from Mr. Carbutt,

The motion was withdrawn.

*ON THE TRIPLE EXPANSIVE ENGINES OF THE S.S. "ABERDEEN."

By A. C. KIRK, Member of Council.

April 29th.

ECONOMY of coal in our steamships is a point of so great importance that any step in this direction is worth chronicling. Steamships are now making long voyages, and at high rates of speed, which, till within a few years ago, were made by sailing ships. To accomplish these profitably, economy of coal is all important. Every ton of coal saved means a ton of freight earned, and in many trades every stoppage to coal is a loss of time, besides the exorbitant rates for coal charged at these ports. Coal-saving, too, is equally important for high-speed steamers, as, unless their voyage is only one of the shortest duration, coal becomes the greatest weight the ship is burdened with. The obvious direction in which to look for saving is increase of pressure. Unfortunately, as we get higher in pressure, we do not by any means gain in efficiency in anything like a proportionate degree, and the time must come, may indeed not be far away, when farther increase of pressure will not pay. This time has not come yet. When James Watt utilized the lower pressures, from 15 lbs. downwards, he unquestionably had at his disposal the most prolific portion. Pressure gradually rose—I am speaking now more particularly of the marine engine—to 30 lbs. and sometimes 40 lbs., but, used as the steam was, in one cylinder, exhausting direct to the condenser, little additional economy was gained by this increase of pressure. The variation in temperature, over 300° in the cylinder, was too great; steam was condensed at the commencement of the stroke when it had its full work before it, and re-evaporated towards the end when it had little left to do but go straight to the condenser. Steam-jackets ameliorated this action, but besides the difficulty of getting them attended to at sea, they effected their purpose imperfectly, and at a very considerable sacrifice of steam. The next step was to divide the work between two cylinders, effecting part of the expansion of the steam, first in one cylinder, and completing it in a second, thus limiting the range of expansion and of temperature in each cylinder. Several incidental advantages accompanied this change, which we need not advert to here. A marked economy followed this improvement, and when a pressure of 60 lbs. per square inch was reached, the economy over the older form was very marked; in round numbers only about half the coal was required. For six or seven years the pressure in use remained, for the most part, at 60 lbs., but of later years a gradual and steady increase of the working pressure of steam in our steamships has taken place, 100 lbs. being now not uncommon. So far, however, as the imperfect data obtainable of steamship performances at sea show, the increase in economy of fuel has made but little progress, and I am not aware that any perceptible increase of economy has been attained by exceeding 70 lbs. to 75 lbs. pressure. In fact, the compound or double-expansion engine has relapsed into the condition of the old single-expansion one. This gradual increase of pressure, using all the time the ordinary type of internally-fired, fire-tube boiler, has dissipated at once the mistrust of boilers of larger diameters, and the craving for boilers composed of water-tubes and other such complicated arrangements. These may yet have their day. However, I am indebted to one of these water-tube boilers for having driven me seriously to take up the question of utilizing advantageously steam of much higher pressure than was at that time generally in use. While I was with Messrs. John Elder & Co., in 1874, Mr. W. H. Dixon, of Liverpool, anxious to attain greater economy of fuel, made up his mind to fit his steamer *Propontis* with high-pressure water-tube boilers on Messrs. Rowan & Horton's patent, and thus I had to consider the best engine to utilize this high-pressure steam advantageously. Being thoroughly convinced that the great secret of success in the ordinary compound engine of the day over the earlier simple engine (even the Woolf engine) lay in the range of temperature through which the steam in any one cylinder passed in the course of one stroke, being very much reduced (nearly halved in fact, compared with a single cylinder), it seemed to me that with these high-pressures, we must use three successive expansions, and divide the total range of temperature into three parts. Of course this was incidentally favourable to a more uniform distribution of strain, reduced leakage to the condenser, &c. Thus the engines of the *Propontis*, constructed in 1874 for a steam pressure of 150 lbs. per square inch, consisted of three cylinders of progressive capacities, the smallest being the high pressure to which the steam was first admitted, next the intermediate one to which the steam passed from the high pressure cylinder, and the third the low pressure cylinder, receiving the steam from the intermediate cylinder and discharging it into the condenser. The arrangement consisted of a three-throw crank with a cylinder above each, and possessed no specialities of construction or design. Unfortunately the boiler very early gave trouble, and ultimately was taken out, the causes of which do not come within the scope of this paper, but during the time it worked at its full pressure I found, on comparing the diagrams with those of an ordinary compound engine, that these engines ought to have required only about 1⅓ lbs. of coal per indicated horse-power. The practical results of working the engines were satisfactory, no difficulties being introduced by the use of high-pressure steam; indeed, they are at work to the present day, though at reduced pressure. For when Mr. Dixon took out the water-tube boilers, the idea still haunted most people that an internally-fired boiler was unfit for such high pressures, and the new boilers of the ordinary type only carried 90 lbs.—still a high pressure for such a boiler in the year 1876. These engines are still doing good work in the *Propontis*. From that time till January last year (1881), when Messrs. George Thompson & Co. entrusted to my firm (Messrs. R. Napier & Sons) the building of the *s.s. Aberdeen*, I failed to find anyone who cared to make so long a step, and in doing so I hope Messrs. Thompson will have their reward.

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*Read at the Twenty-third Session of the Institution of Naval Architects.

In designing a ship for the long voyage their ships make from this country to Australia and China, more importance attaches to a small consumption of coal than in ships making shorter voyages, and it was necessary to use every device to attain this end. The engines of the *Aberdeen* are essentially of the same design as those of the *Propontis*, the cylinders being 30 inches, 45 inches, and 70 inches by 4 feet 6 inch stroke. The boilers, two in number, are ordinary double-ended boilers, constructed entirely of steel, with six of Fox's corrugated furnaces in each, the total heating surface being 7,128 square feet. There is no superheater. The construction of these boilers, for so high a pressure—125 lbs. per square inch—was facilitated by their being built of steel and to Lloyd's, whose rules allow the shells to be made thinner than required by the Board of Trade, although the internal parts are as strong as those required by the latter. After all, the shell is the simplest and strongest part of a round boiler, where, even if built to Lloyd's, there is superabundance of strength, but to doubly ensure success—the internal parts of a boiler being those which oftenest give trouble—they were made stronger than required by either Lloyd's or the Board of Trade, whose scantlings for these parts are practically the same. The high-pressure cylinder was not jacketed, the second was jacketed with steam of 50 lbs. pressure, and the low-pressure one with steam of 15 lbs. above the atmosphere.

The *Aberdeen* is a ship built of iron, both ship and engines being to the highest class at Lloyd's, 350 feet by 44 feet by 33 feet. When the ship was complete, 2,000 tons of deadweight were put on board, and arrangements were made to test the consumption on a six hours' run at 1,800-horse power; this, however, by the owners' desire, was reduced to four only. The coal was Penrikyber Welsh coal, and Messrs. Parker & Dunlop, who happened to be on board, kindly undertook to examine the state of the fires, and see the coal weighed. The result was a consumption of 1·28 lbs. per indicated horse power. According to usual analogy, we should expect from this a sea consumption of good Welsh coal of from 1·5 to 1·6 lbs. per indicated horse power. The next trial was to find the maximum speed, which, on four runs on the measured mile (occupying two hours), was 13·74 knots, the mean power being 2,631, and the consumption of coal during these two hours being 1 ton 17 cwt. per hour. I am aware that the consumption of coal on so short a trial is not of implicit value, but the trial was made with the utmost care, and is thoroughly reliable so far as it goes. The engine, I ought to mention, is fitted with "Weir's" feed-heater, with a view to the better preservation of the boilers. I mentioned above that the high-pressure cylinder was not steam-jacketed, while the others were. As it did not seem to me that the value of jackets could be great in such an engine, with so limited a range of temperature in any one cylinder and a considerable speed of piston, I sacrificed the steam jacket in the case of the high-pressure cylinder, purely from prudential motives, (the voyage being a very long one), to avoid any chance of cutting, when worked with very little lubrication, as it was desirable the engine should. Farther, when we take into account the thickness of the interior chamber of the cylinder and the speed of piston, it is not conceivable that the interior surface of the chamber can be maintained by the steam on the outside of it, at a uniform temperature. In fact, the slower an engine runs the more efficient the jacket becomes. There is no doubt that in such an engine as the above, or, indeed, in any compound engine when the range of expansion and temperature is kept within moderate limits, that economy from the use of steam jackets is at least small; that, in fact, the steamed condensed in the jackets, if admitted to the high-pressure cylinder, would have been for all practical purposes as efficient. This has been a fortunate thing for the compound marine engine, as it is always extremely doubtful if, at sea, the steam jackets receive the attention they require to make them efficient. These remarks do not apply when engines are being worked at comparatively low powers. I may mention that the weight of steam condensed in the jackets, carefully measured into a tank, was 3¾° per cent. of the greatest weight of steam admitted to the high-pressure cylinder (by diagram), the pressure on the jacket of the middle cylinder being 30 lbs., and on the low-pressure cylinder 10 lbs. In a second experiment, the condensed water was still the same percentage when the pressure in each jacket was doubled. I may mention that the loss of steam from the high-pressure cylinder to the low-pressure, just before release, plus the steam condensed in the jackets, was the same as took place inside the cylinders with the steam shut off from the jackets. I do not, however, quote this as absolutely conclusive, for, by an omission, Weir's feed-heater was connected and at work on both trials, abstracting a certain amount of steam from the low-pressure receiver. Still I feel certain the result is tolerably correct, as the quantity abstracted by the heater must have been very nearly in the same proportion on both occasions. But a much more conclusive argument is to be found in the trials of a compound engine at Blackburn, made by Mr. Longridge (see *Engineering*, February 24th, 1882), where it will be found that the feed-water per indicated horse power per hour was, when no steam was in the jackets, 16·87 lbs., and when all the jackets were supplied with steam, 17 lbs.; on a second trial, the figures were respectively 16·97 lbs. and 17·16 lbs. Unfortunately, at sea, it is extremely difficult to get data of this sort with the completeness

Mr. Longridge was able to carry out on land. I made complete arrangements for some further experiments on the way from Glasgow to London, but owing to the state of the weather, my good intentions, to a great extent, fell through.

The form of engine adopted on board the *Aberdeen*, of three cylinders, each over a crank, though a very convenient form for overhauling and giving a very uniform rotary motion, is not, by any means, the only form in which such an engine can be arranged. Indeed, from the unwieldy dimensions the low-pressure cylinder would attain, it would not be advisable for large powers. About four years ago—but several years subsequent to the *Propontis*—Messrs. Douglas and Grant, of Kirkaldy, made a comparatively small set of marine engines for the *Isa* with triple expansion, by placing the first, or high-pressure, above what in an ordinary two-cylinder compound engine would be the high-pressure cylinder. This makes a neat and, in some cases, a convenient arrangement, but is open to the objection that, if you make the ratios of expansion approximately equal in each cylinder, the strains are very unequal, as also the several ranges of temperature. A better arrangement is, to have two low-pressure cylinders, with the high-pressure cylinder on top of one, and the intermediate cylinder on the top of the other. This arrangement is adapted to high powers, and does not occupy any excessive length. It is also the best plan for altering a compound engine of the present type into a triple expansive engine, as it does not alter the strains on the cranks, connecting rods, &c. It farther lends itself to certain horizontal arrangements of engines, as are used in unarmoured ships of war. The weight of the machine would not be perceptibly increased, while the weight of coal to be carried would be considerably reduced.

* OCEAN STEAMSHIP MACHINERY.

A SERIES OF PRACTICAL PAPERS ON THE DESIGN, CONSTRUCTION, AND MANAGEMENT OF THE MACHINERY OF STEAMSHIPS.

By H. Holt-Butterfill, Marine Engineer.

Continued from page 262.

I.—The Problem of Ocean Steam Navigation.

THE introduction in 1854, by the Messrs. Randolph, Elder & Co., of the *compound* principle in marine engines—now so universally adopted—together with the addition of the surface condenser and multitubular boiler then brought into use, placed within the reach of the existing steamship companies a type of machinery which had been proved—in the case of the vessels fitted—to be a splendid success. Yet, as in many other like cases, the parties who should have derived the greatest benefit from these improvements were the slowest in adopting them.

Long ocean voyages by steam, such as those to India, China, Australia, &c., were, so long as the old type of machinery was persisted in, rendered both practically and financially impossible. The Pacific Steam Navigation Company, formed we believe about the same time as the West India Mail Steam Packet Company, laboured under greater disadvantages than the companies on the shorter routes, consequent upon the difficulties in connection with the coaling of their vessels. It was, however, the *first* company by some years to adopt engines on the *compound* principle with surface condensation; the *Valparaiso*, built for them as early as 1856 by the Messrs. Randolph, Elder & Co. having all the latest improvements made in the machinery fitted to her.

Why the private shipowners of that date did not more largely avail themselves of those improvements it is difficult to understand, except on the assumption that they did not appreciate the great loss incurred in the continued use of the old type of machinery in comparison with the newer. The ratio of consumption of *fuel* in the two types was fully 4½ to 2 lbs. of coal per indicated horse power, and the carrying capacity of the same ship fitted with the newer type of machinery would be at least as 2 to 1. Another item of gain—not an unimportant one—would be in the duration of the improved multitubular high-pressure boiler over the old type of low-pressure flue boiler.

The carrying trade now performed by the large ocean steamships of the Peninsular and Oriental, the Pacific, the Union, the Orient, and other Navigation, &c., Companies to India, China, the Cape, Australia, &c., was for many years entirely monopolised by the large sailing ships; but since the opening of the Suez Canal, and consequent saving in the length of the voyage eastward, steam vessels have been built embracing every improvement in construction and machinery, and are thus enabled successfully to accomplish the longest of ocean voyages.

The triumphs of modern ocean steam navigation are worthy of more than passing notice. The *Gallia*, one of the late additions to the Cunard line (built in 1879) her engines indicating 5,000 horse power, carries, in addition to her passengers, stores, and coal, some 1,700 tons deadweight of cargo, which she delivers at a cost of half-a-ton of coal for every ton of cargo carried, the speed at which it is carried being on an average 15½ knots per hour. The *Arizona*, of the Guion line, built in the same year as the *Gallia*, and indicating 6,000 horse power, carries 3,400 tons of cargo in addition to her coal stores, passengers, &c., at a cost of about 5 cwt. of coal for every ton of cargo carried, her average steaming speed, when fully laden, being about 16½ knots per hour. This vessel has, we believe, accomplished the quickest passage on record.

The Cape route is now traversed by the steamers of the Union Company, and those of Messrs. Donald, Currie & Co., performing the voyage from port to port in about 20 days. The far-famed vessels of the Peninsular and Oriental Steamship Company perform the voyage to and from the Indian ports, &c., with the greatest regularity and despatch; and the longest of voyages, viz., that from England to Australia, a distance of from twelve to thirteen thousand nautical miles, is now regularly made at an average speed of rather more than twelve knots per hour from port to port on a consumption of coal of not more than 1,500 to 1,600 tons.

A comparison of the actual duty performed by the pioneer ship, the *Great Western*, and the magnificent vessels now employed in the same service, will give a fair criterion of the progress made within the past half-century in the matter of ocean steam navigation.

The *Great Western* consumed from 400 to 500 tons of coal in driving her own weight (about 2,000 tons) a distance of 3,000 miles, at a speed of from eight to nine knots an hour. A modern Atlantic steamer, whose deadweight is nearly four times that of the *Great Western*, will attain an average speed of from fourteen to sixteen knots an hour on an expenditure of coal only little more than twice that of her predecessor.

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* The Author reserves the right of re-publication and translation of these papers.

We may, as a nation, with some pride take credit to ourselves for what we have achieved in the past in the way of *results* due to improvements in our ocean steamships and their machinery. But although much has been done, there is yet, we believe, a wide field for still greater improvement, not only in the form of ships and their propellers, but in that of the propelling machinery itself. Let us hope that our naval architects and marine engineers will look on past achievements as an incentive to still greater progress towards perfection in the design and construction of ocean steamships.

We have throughout the foregoing remarks abstained from saying anything in reference to the *Great Eastern*, or that latest production of the combined skill of the naval architect and marine engineer, the *City of Rome*. The former of these vessels, although in every respect a fine specimen of workmanship in both hull and machinery, does not unfortunately so far, fall within the category of *successful* ocean steamships, practically or commercially. Any remarks in reference to the capabilities of the *City of Rome* would be premature, seeing that she has not as yet had a thorough trial in the service for which she has been specially constructed. It is, however, our hope and belief that we shall shortly see the "Atlantic Ferry" crossed in the space of six days by one or other of the magnificent vessels that are now being made ready for this trial of speed.

II.—The Problem of Ocean Steamship Design.

When one comes to consider the many requirements which have to be fulfilled in the design of the *hull* alone —apart altogether from the internal arrangements, &c.— of such a structure as an ocean-going steamship, the student will not be surprised to learn that the subject of *design* in Naval Architecture is a problem involving so many previously unknown quantities as to be incapable of general solution, and that without a large resort to practical experience the true requirements of such a ship cannot be thoroughly understood.

It is, therefore, not usual to find that marine engineers are at the same time naval architects, although we have some notable instances of such a combination of talent. But as it is important that every efficient marine engineer, whether sea-going or otherwise, should know something of the principles involved in the *design* of the ship—the machinery of which he may possibly be called upon to assist in creating, or managing when completed—we deem it desirable to state briefly the *qualities* necessary to a ship which the naval architect endeavours to combine in her, in the manner best suited to the purpose for which she is intended.

Apart from the question of the *strength* and *durability* of such a structure as a steamship—a vessel intended to carry a burden, in the shape of cargo, equipment, fuel, and machinery safely and steadily upon the sea, through which she is to be propelled by motive power generated within her, her movements at all times being under control—the *qualities sought* for to enable her to fulfil her requirements are primarily *three-fold*; she must have:—

(1) *Buoyancy*, or, in other words, she must be able to *float* on the surface of the water, when laden, without sinking too deeply in it, or swimming too lightly upon it.

(2) *Stability*, or the power to *right* herself when, by pressure of either wind or wave, or other disturbing cause, she is removed from an *upright* position, her deviation from that position never exceeding that which is consistent with safety or convenience, or her motion when inclining so great or sudden as to induce straining or damage to her structure or contents.

(3) *Speed* sufficient to propel her through the water at such rate as is suited to her intended service, regard being paid to due economy in the means employed in obtaining such speed.

(*To be continued.*)

THE CARPENTERS OF THE ROYAL NAVY, THEIR DUTIES, RESPONSIBILITIES AND NEGLECTED POSITION.

On looking carefully into the organization of our royal naval mechanics, artificers, designers, &c., the poor recognition at present given to the carpenters, skilled shipwrights and shipwrights, seems almost incomprehensible.

It has for many years past been a growing trouble to obtain skilled men in the above-mentioned branches, and this difficulty is still as great, if not greater than ever. At a time, when our navy comprises ships of such great value as our present ironclads represent, one alone of which may be said to be worth a small squadron of the old wooden type, it is certainly most essential that such costly floating machines should be kept in a thorough state of repair by constant supervision and unceasing attention. Naval construction, both theoretically and practically, has made such gigantic strides, the value of a single ship has so enormously increased, and the duties and responsibilities of the carpenter have so multiplied, and become so onerous, that a description of the knowledge and ability required to carry them out in a proper and efficient manner will probably lead to the conclusion that these requirements have been so little known or studied that a most valuable branch of our naval power has been grossly neglected and ignored, to the great detriment of efficiency, and giving also the greatest dissatisfaction to a large body of highly deserving mechanics.

In noticing the qualifications for the rank of carpenter we will first take the "acting carpenter." At page 55, Art. 18, of the "Queen's Regulation and Admiralty Instructions," it states:—

"To qualify a person to receive a carpenter's warrants, he must have served a regular apprenticeship to a shipwright, and have been six months at least carpenter's mate or caulker, or twelve months with the rating of shipwright, or one of the carpenter's crew, in one or more of Her Majesty's ships."

Again, at page 71, Art. 34:—

"The candidate must produce satisfactory proof of being qualified according to the foregoing regulation, and must produce his certificate of service, ability, and conduct, and satisfactory proof of his being a good shipwright, and proof of his age, and that he understands caulking; that he knows how to fish masts and yards in a ready and efficient manner, and to calculate the proper proportions for making them from rough spars; that he can write sufficiently well to keep a rough account of his stores in clear and intelligible writing; that he understands the use of figures, and that he is in all respects capable of executing the duty of carpenter of one of Her Majesty's ships."

Should the candidate succeed in passing this preliminary examination, he is in the course of time promoted to the rank of acting carpenter, and should he wish to have his warrant confirmed he is confronted by farther examinations and tests as follows:—

Circular No. 7.—C., 28th February, 1872, paragraphs 1 to 3 states:—

"1.—All acting carpenters to be required to pass a final examination, before a board of dockyard officers, before they receive their confirmation."

"If, in England, acting carpenters to be required to pass such final examination within six months of their acting appointment."

"If abroad, to be required to pass this examination within six months after their arrival in England."

"They will be required to keep accounts of the works that come under their observation, with sketches, which are to be forwarded monthly to the Admiralty for examination, after which they will be returned to the officers."

"Referring to the foregoing circular, par 1, my Lords Commissioners of the Admiralty are pleased to direct that the following subjects shall form part of examination, viz:—Knowledge of how wood, iron and steel, masts and yards, are constructed; how to fish masts and yards of wood, steel, or iron, in a ready and efficient manner; ability to calculate the proper proportions for making masts and yards from rough spars, ability to describe the manner in which the two thicknesses of sheathing in composite or iron sheathed ships are secured to the frames or plating, and the manner in which a wood deck is secured to iron beams, stringer-plates, or iron deck; knowledge of how the keel, stem, stern-posts, and rudders of iron ships are formed; and how the stem and stern-posts are secured to the keel; how the stern-tube is formed; how the bulkheads are secured to the ship's side, and how they are stiffened; how water-tight doors and sluice-valves are formed and worked; how iron beams are secured to the ship's side; ability to describe the transverse and longitudinal framing of a ship; and the formation of the double bottom; ability to show how iron plates are united to one another, and to the iron frames; to describe the method of securing the armour to the ship's side; and to describe the pumping arrangements in ships with or without a double bottom; also knowledge of the ventilating arrangements generally fitted in Her Majesty's ships."

After a carpenter has satisfactorily passed the required examinations, he waits his turn for an appointment to a sea-going ship, during which time he is engaged in one of Her Majesty's dockyards in surveying a ship in course of construction, of which he has to keep an account in the shape of a journal.

In order to obtain an adequate idea of the knowledge and ability required, together with the responsibilities attached to these duties, it is necessary to give a synopsis of the requirements of this really valuable journal.

It is intended to be a complete history of the ship; it differs from the specification, in that the journal describes the ship as it is; the specification as it is to be, or as nearly so as possible.

It commences with the principal dimensions, and other important particulars of the ship; then the keel, stating when it was laid, describing the length, breadth, and thickness of the plates, angle-irons, butt-straps, covering-straps, rivets, and pitch of rivets that compose it, with sketches in detail, and so on, taking everything in order—keel, frames, longitudinals, connection of stem and stern-post with keel, showing the position and description of the scarphs, inner and outer bottom plating, bulkhead, beams, watertight flats, decks, wood-backing, armour-plating, watertight doors, sluice-valves, sounding-tubes, pumping, ventilating, and fire arrangements; number of coats and description of paint, both inside and out, with dates of painting; number of coats and description of anti-fouling composition, with the dates on which it was put on; dates of docking and undocking; dates and description of all repairs and surveys; all draughts of water from time of launching; weights of all important articles, especially moveable ones; and drawings in detail of all parts of the ship.

Taking into consideration the fact that the carpenter has to take all the measurements from the ship personally, and make all the drawings requisite for the completion of the journal, it must be admitted that such important duties call for special requirements and abilities on his part.

In addition to the foregoing, the carpenter has to superintend, in conjunction with the dockyard authorities, the fitting out and completion of the ship—viz., arranging the various fittings necessary for her efficiency and working, by providing for any emergency, whenever or however it may arise; arranging the stowage of all spare stores and fittings, and all spare gear; sleeping and messing arrangements; efficiency of mast, yards, boats, &c.

In a future number the duties and responsibilities of the carpenter when at sea in full charge of a massive hull, worth from £300,000 to £400,000, will be set forth, and the remuneration they receive as compared with the value of similar services in different employs and positions.

It will probably sound startling to state briefly that a shipwright on shore receives from 5s. to 7s. per day; but, on joining the service as a shipwright, he only receives from 2s. 3d to 2s. 6d. per day; if promoted to carpenter's mate from 2s. 6d. to 3s. 0d. per day; and if successful in passing the ordeal necessary to fit him to undertake the arduous duties of a carpenter, he obtains the remuneration of 5s. 6d. per diem for the first five years of his service.

It is a matter, which some officials are at a loss to understand, why men are not to be obtained in abundance for any branch of H.M. service. If the above officials were to glance over a few comparisons such as these, their astonishment would doubtless immediately come to an end, or they would possess a larger idea of the *honour* and *glory* of men serving her Majesty with a chance of risking all the eventualities of a naval combat, and the risks of a sea-faring life for 2s. 3d. per day, as compared with a peaceful life on shore and a remuneration of from 5s. to 7s. per day, than our brave man-of-war's man has ever been credited with.

(*To be Continued.*)

LAUNCH OF HER MAJESTY'S SHIP "EDINBURGH."

VAST crowds were in eager expectancy of the launch when at 4 o'clock the Duke and Duchess of Edinburgh and party took their places. The working of the launching apparatus was explained to their Royal Highnesses by Chief Constructor C. E. Warren. Prayers having been read by the Rev. Mr. Nicholls, dockyard chaplain, the Duchess pressed the lever, and the vessel glided into the sea amid the ringing cheers of those aboard and ashore. The health of the ship was then toasted by the Royal party, and the ceremony ended.

The launching apparatus provided for the use of the Duchess was made in the Royal Dockyard, and was presented to her Royal Highness by Chief Constructor Warren. The handle of the lever is beautifully carved, and surmounted by a golden lion, on one side being a silver plate bearing an inscription, and on the other the Royal Standards of England and Russia. The box in which the handle is enclosed is handsomely carved, the lid being inlaid with a small drawing of the *Edinburgh* in a frame of intricate work, with the Russian crest. The *Edinburgh* is 325 ft. long, and 68 ft. broad. Her present weight is 4,800 tons, but when she is equipped this will be increased to 9,150 tons. Her armament will be four 43-ton breech-loading guns in turrets, and four six-inch breech-loading guns in the superstructure. She will have an indicated horse-power of 6,000, and a crew of 400 men. She will have 10 Nordenfelt guns for defence against torpedo boats. In construction she is very much like the *Ajax*, launched at Pembroke a couple of years ago. She has a central armour belt of three inches upon one inch, with nine and a-half feet freeboard, and six feet depth below load-water-line. The armour is in two strips, the upper being 14 and the lower 18 inches thick, over a parallel breadth of four feet at the load water-line, from which it tapers to eight inches. The semi-circular ends of the belt, which are not so thick, are covered with protective plating three inches thick. In the wake of the ports the armour is 16 and elsewhere 14 inches thick. The ram is forged as a part of the stem, beyond which it projects six and a-half feet at about nine feet below water-load-line. There are protective decks three inches thick four feet below load-water-line, and extending two-thirds of the length of the armour belt, and before and abaft it. These decks are protected from the inflow of large quantities of water if the ship is struck below water by cork chambers and coffer dams. The engines are supplied by Messrs. Humphreys & Tennant, of London, and are of 6,000 indicated horse-power, the screw being driven by an independent set of engines of 3,000 horse-power. The *Edinburgh's* speed will be 14 knots.

STEAMTUG building on the Tyne is in a more prosperous condition at present than it has been for a number of years past. Both wooden and iron tugs are in process of construction to local and distant orders. The Clyde Shipping Company, who have already had between 20 and 30 of their fine fleet of tugboats built on the Tyne, have now no less than five more in course of construction. These additions to the Clyde Company's fleet are intended to replace five other boats that have been sold for the steam trawling business carried on at the neighbouring Ports of Sunderland and Middlesbrough and at Scarborough. It may also be mentioned that a steam trawler of a powerful build, and designed on what is believed to be a much improved principle, is at present being built on the Tyne. Repairing work at most of the yards used for the purpose on the river side is at present plentiful.

NAVAL AND SUBMARINE EXHIBITION.

THIS Exhibition, which opens on Easter Monday, the 10th inst., at the Agricultural Hall, Islington, and remains open till the 20th inst., will amply repay each and all who visit it by the immense variety and exceedingly interesting nature of the different exhibits. Numerous Exhibitions of all kinds succeed each other in rapid order at this well known spacious building, but it is doubtful if one of greater interest from every point of view was ever before held in this Hall. Whatever ideas may exist in the minds of intending visitors as to the national importance of our naval and submarine industries, they will fall far short of the actual extent to which nearly every mechanical calling is affected by this leading branch of business peculiar to our maritime nature and history.

When attention is called to the number of iron works throughout the Kingdom, nearly, if not wholly, supported by the manufacture of ship iron, the number of engineering and shipbuilding works kept entirely going by means of our extensive monopoly of ship work, the vast quantity of coals consumed by the different manufacturers, the high pitch to which submarine engineering has been worked, and the millions of the working classes dependent on the many branches of work connected with marine engineering, the national importance of our marine inventions and their productions will at once rank as one of the foremost in the kingdom. Besides the leading industries mentioned, there are a legion of minor products of different kinds, wholly devoted to ship and submarine work. This exists to such an extent that nothing short of a visit to the Exhibition would lead to a full understanding of the many ways in which nearly every business is affected by the extent of our naval and submarine engineering work.

In our issue of Feb. 1st the fact was mentioned that this Exhibition promised to be most successful, and that prediction has been quite fulfilled. There is now no doubt that the Naval and Submarine Exhibition of 1882 will rival in interest and attraction any exhibition ever held in this or any other country. The only astonishing thing being that, notwithstanding the national importance attached to these exhibits, nothing of a similar kind has taken place for over a quarter of a century.

We would direct attention to a notice of a few of the things which are to be seen at this Exhibition, and in our next issue will devote a considerable space to a description of the principal things exhibited.

MESSRS. BULLIVANT AND CO.,

exhibit many specialities of a highly interesting and useful nature.

Their patent flexible steel wire hawsers and cables are a very great improvement on either hempen hawsers or chain cables. They are only one-third the weight of hempen hawsers, and one-seventh the weight of chain cable of equivalent strength, and they are so pliable that they may be worked round a bitt or bollard, round which a hempen hawser of equivalent strength could be worked. These hawsers last much longer than hemp, and are much cheaper. They may be rove through blocks for lifting heavy weights, used as tow-lines, or for any purpose to which a hempen hawser or rope could be applied, with a great saving in weight and cost, and a great gain in guaranteed strength.

The patent flexible steel wire rope is used for all kinds of running rigging. It will stand a much larger amount of wear and tear than hemp. On account of its limited size all blocks may be made smaller, and by its extreme lightness the top-hamper of a lofty rigged sailing vessel is considerably reduced in weight. This rope is also extensively used in fisheries.

The patent steel wire rope for rigging in place of ordinary wire rigging reduces the weight of the standing rigging by one half, and with Messrs. Bullivant's guaranteed breaking strain will give three times the support to the masts.

Their improved patent automatic nipper, which has been invented specially for use with the patent flexible wire hawsers and cables, possesses many advantages. The greater the strain upon the hawser the tighter the nipper grips; the hawser can be released with perfect safety while a strain is upon it, and gripped again; a nipper and hawser of 5¾ inches in circumference, tested in the presence of the head officials of Lloyd's Registry and of the Admiralty, gave the following results:—At a stress of 50 and 81¼ tons respectively the nipper was applied and released by one man. The rope broke at a strain of 86·3 tons, the guaranteed breaking strain being 80 tons.

Patent Torpedo Net, as supplied to the Admiralty and foreign Governments.

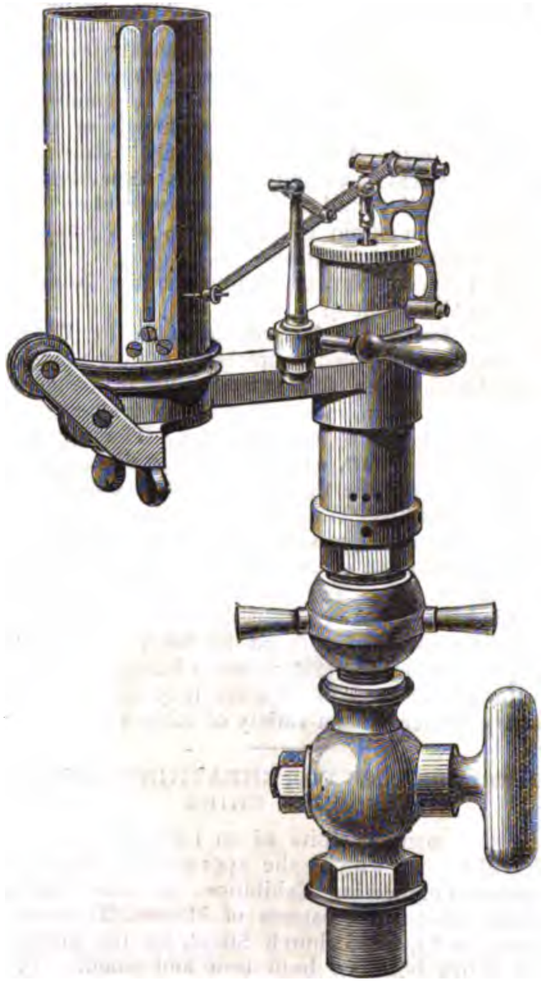
Improved Patent Sea Anchors, invented for the purpose of enabling disabled steamers and other vessels to ride out heavy gales and storms without danger of falling broadside on in the trough of the sea, or of getting pooped by a following sea. The apparatus consists of a small raft, with just enough floating power to enable it to support the weight of the oblong bags or drogues and Steel Wire Towing Hawser. The Sea Anchors can be adapted to any size of vessel by the addition or reduction of the number of bags or drogues attached to the raft. The resistance offered by the Sea Anchor is kept as nearly as possible equal to the resistance at different speeds offered by the vessel to which it is supplied when the said vessel is being towed. The raft without the bags or drogues may be used as a temporary rudder, or in a variety of other ways.

VITREOUS PLATES FOR SHEATHING IRON AND WOODEN SHIPS.

Among the many exhibits of an important character which will be met with at the approaching Naval and Submarine Engineering Exhibition, we have had our attention called to the patents of Messrs. Thomson & Company, of 85, Gracechurch Street, for the preservation of ship's bottoms, both iron and wood. Their method consists in affixing either Vitreous Plates, Copper or Yellow Metal Sheathing to the submerged hull by means of their patented process of rubber or other suitable substances. We are informed that when the sheathing has been thus fixed it adheres so firmly to the bottoms of vessels that it is necessary to use a hammer and chisel to remove it. The patentees also claim advantages as far as the non-accumulation of barnacles, grasses, sullage, &c., that the bottoms of the ship will keep clean and in perfect preservation for years, and what is very important, the impossibility of galvanic action taking place where Copper or Yellow Metal is used on iron ships. Want of space prevents our going more fully into the matter at present, but we shall probably do so shortly.

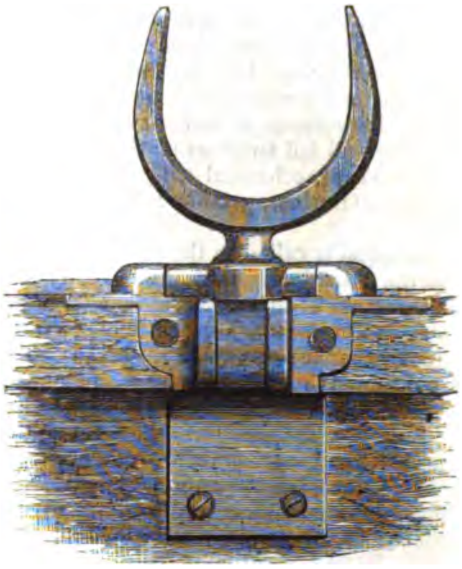
THOMPSON'S PATENT INDICATOR.

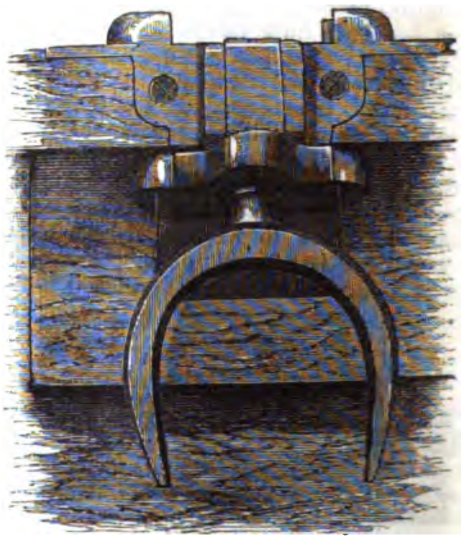
The annexed plate shows this instrument, which is of an excellent quality, and provided with every convenience. The indicator springs are interchangeable, and fit every instrument; they can be easily and readily changed. The size of the diagram is 3⅛ by 5 inches. It is drawn on metallic paper by a pointed brass wire. The piston has 'an area equal to one-half of a square inch, which is the smallest size that will ensure accuracy in the diagram. These may be arranged with special attachments for application to oscillating cylinders or any special requirement. Springs showing pressures above 80 lbs. may be made to indicate the vacuum also, or to any other scale. This Indicator will provide perfect diagrams with high speed engines, and likewise with low pressure. All the moveable parts are arranged with every attention to the lightness of the working parts and complete steadiness without friction. Perfect diagrams could be taken with this instrument up to 435 revolutions per minute.



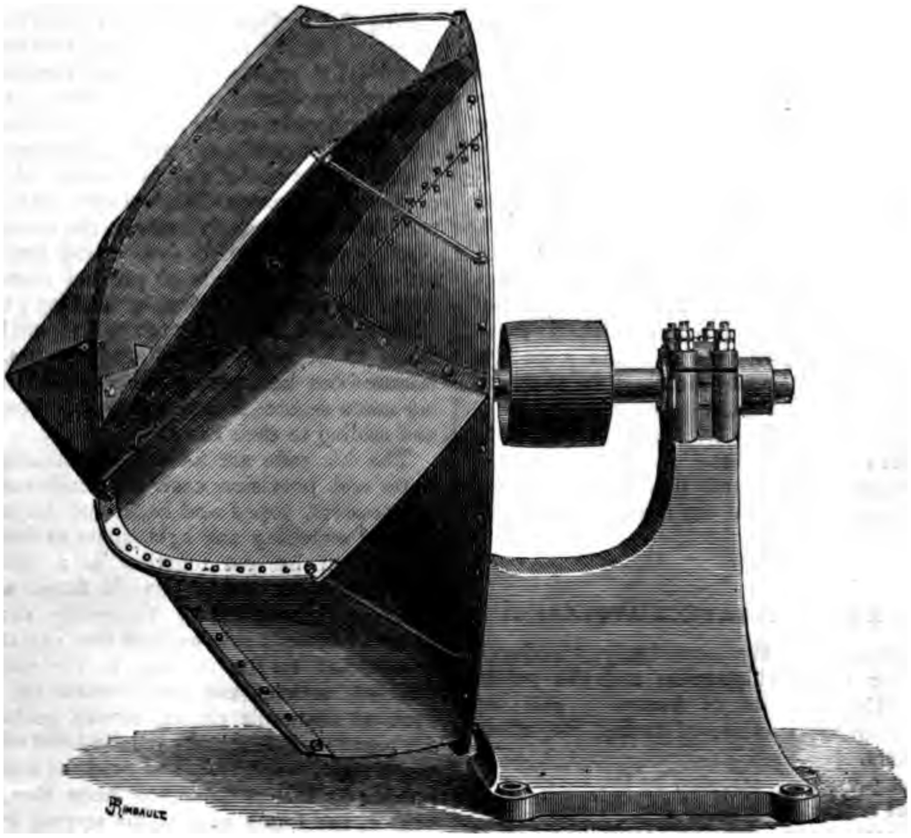
MESSRS. CLEARE AND MARTIN.

exhibit an Improved Patent Rowlock, which is shipped and unshipped in the easiest manner under any circumstances. By using this rowlock, the perilous delay caused by the attempting to ship an ordinary rowlock or thole-pin is avoided, possibly tending to the saving of lives which might otherwise be sacrificed. It is quite noiseless when the boat is being rowed, and would, on this account, be of great service to whalers and to men-of-war boats undertaking a secret attack on an enemy. The rowlock may at any moment be turned down under the gunwale and replaced again, thus preventing the injury by gouging caused by a boat with ordinary rowlocks riding alongside yachts, &c.



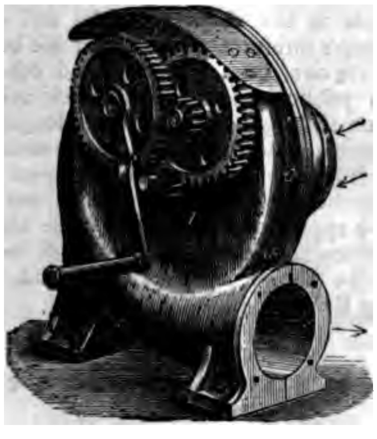


THE PELZER SCREW VENTILATOR.

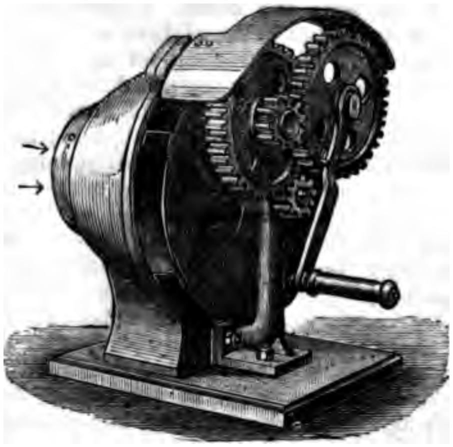


PELZER'S PATENT CENTRIFUGAL SCREW VENTILATOR.

We give engravings of Pelzer's Patent Centrifugal Screw Ventilator, constructed by Messrs. Petry & Hecking, of Dortmund, a small specimen of which will be shown at the Naval and Submarine Engineering Exhibition by Messrs. Schaffer & Budenberg, of London.



The apparatus which may be used for all kinds of ventilating purposes, consists of a screw or propeller placed upon a shaft, and is driven at a speed varying according to its size. The propeller consists essentially of a series of wings set equally pitched on the conical-shaped back plate. Fans of this description are said to give excellent results, due to the fact that the air taken by the forward parts of the wings is gradually led into the recess between the wings and the cone-shaped back plate, and thence discharged by centrifugal force. In other words, the air is gradually screwed by the slanting wings to the periphery of the cone, and then thrown out by centrifugal force, thus utilizing the two functions where heretofore but one was used.



As a matter of fact the system is largely used in Austria, Germany, and lately also in this country, and is presently about being introduced in America, through a well known American mining and general engineering firm having purchased the sole license from the inventor.

When used in the ventilation of ships, the Pelzer fan is placed in a position where steam or other motive power is available. A system of pipes connects the apparatus with those parts of the ship where foul gases are likely to accumulate, and these are quickly removed through the suction of the fan, the size of which varies according to the size of ships.

The Pelzer fan is said to be capable to remove a larger quantity of air at a given speed than any other fan in existence. A 17 feet wheel, run at a speed of 900 revolutions per minute, exhausts as much as 129,000 cubic feet per hour. Fans of this size and capacity, with a cog wheel arrangement attached to them, as shewn in the engravings, are used to a great extent in coal mines. They are worked by boys, shewing that the system requires but very little motive power. It also requires very little space, and therefore it may be said that it is admirably adapted for the ventilation of ships.

CORNISH'S PATENT LIFE SAVING APPLIANCES.

These practical inventions have been lately introduced to the notice of the British shipowners and the public by Mr. Thomas Cornish, late of Australia, who has given much attention to the cause of saving life at sea or on inland waters.

One of the first principles adopted by the inventor is that of making all articles of general use in and about ships, such as mattresses, couches, seats, &c., of a thoroughly buoyant character, so that each single article will support one or two persons in the water, and by an ingenious and simple method of tying any number of them together, they can be readily made into rafts any shape or size, as circumstances permit. The ordinary sized ship's mattress, 6 feet by 2 feet, possesses sufficient buoyant power to sustain a dead weight of 40 lbs. of iron, or two men; they are constructed in the form of a double mattress, the bottom and the centre piece being of light open Hessian or canvas, to admit of ventilation for airing or drying quickly; the bottom part is composed of a layer of best cork shavings, and the top part of floating fibres or other suitable material, as may be desired; on the top and bottom are two strong web bands running lengthways and three crossways, sewn firmly on the mattress case, where they cross each other, and on the borders, with loose ends for tying together. These mattresses can not only be used singly by each seaman or passenger jumping overboard and floating on the water with safety, but they can be lashed outside of boats to act as a fender while lowering, or when in this position will allow the boats to be tumbled overboard without fear of damage, and when in the water not only materially aids its carrying capacity, but prevents it upsetting or sinking.

Couches for the saloons, seats, &c., are all made to answer a similar purpose, and by the simple method of fastening them together, will help to form rafts, or can be used singly the same as the mattresses.

The life buoy is totally different in shape from the old-fashioned circular one; it is in the form of the letter H, and affords better facilities for swimming or supporting the body when in water, and there is no difficulty in getting into it. This life buoy is specially adapted for saving life, as with one of this form any ordinary swimmer can with safety jump into deep water, and swim to the rescue of any one in danger of drowning, as each buoy will support two persons. The life buoys are made with two cones of solid cork, connected with a canvas band of sufficient breadth to rest the body on as it lays between the cones of cork. The boat projectors are for converting any ordinary boats into absolute life boats, to prevent them being stove in while lowering, upsetting, or sinking; they are in sets of four or six, according to the size and length of boats; made to fit neatly under the thwarts, and in a few minutes can be transferred to the outside, where they are made secure, thus rendering the boats perfectly safe and adding to their carrying capacity.

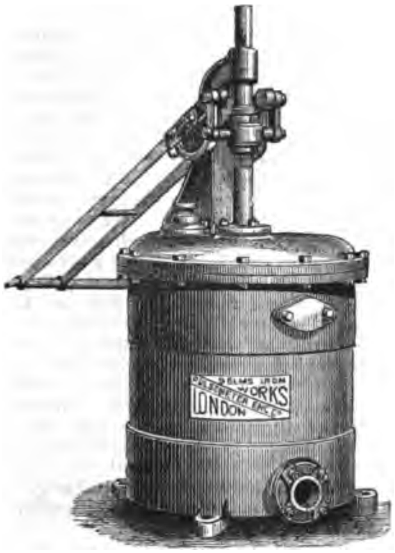
The life rafts are formed by utilising the ordinary water and provision casks, specially made with watertight covers, roped and becketted for the purpose for quickly attaching any light spars to form a framework which can be put together in a few minutes; the space between the spars is fitted with the patent life saving mattresses; the whole can be launched over the vessel's side without fear of damage; it can be constructed on the deck or in the water; many other floatable articles can be attached all round the raft, such as seamen's chests, trunks, portmanteaus, cases, &c., made air-tight and partially filled with food, clothes, or personal property. The mode of making use of these articles for this purpose has been designed by the inventor, and forms part of his several inventions, which we hope soon to see in general use on ships, so as to afford the best means for saving life at sea in time of shipwreck or other disaster.

Excursion steamers and pleasure boats can all be fitted up with Cornish's Patent Life Saving Appliances, so that in case of sudden disaster, such as that of the *Princess Alice*, nearly, if not all hands might be saved from drowning.

The introduction of practical inventions for the saving of human life in the shape of useful and economical articles of ship's furniture, and a useful life buoy in lieu of an obselete one, boat protectors and other articles, are of such public importance that their utility cannot be denied, or their general use much longer deferred. It will become a matter of serious responsibility to those whose duty it is to provide for the safety of crews and passengers if they persistently ignore the use of simple and effective appliances that can be made the means of saving life when accidents from shipwreck occur. The above will be shown at the Naval and Submarine Engineering Exhibition.

THE PULSOMETER ENGINEERING COMPANY, LIMITED,

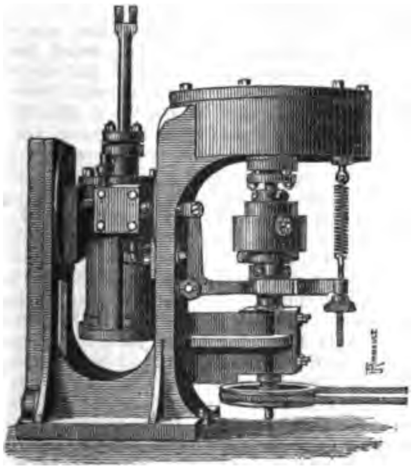
exhibit a Filter which entirely cleanses the most dirty water as it passes into the boilers. All danger of the filtering surface becoming choked, however foul the water in use, is entirely removed. This is effected by the filtering medium's alternate compression and expansion in the cylinder, which is done by hand in the



small sizes, and by power in the larger ones. These machines can be maintained in a thoroughly efficient state by the simple expenditure once in every twelve or twenty-four hours of a little hand or steam power, without taking the filter apart or renewing the filtering medium. The great saving of accumulated dirt in the boilers prevents corrosion and rapid destruction to the iron of which the boiler is constructed, and likewise effects a great saving in coal, as the boiler being always clean, is therefore more easily heated.

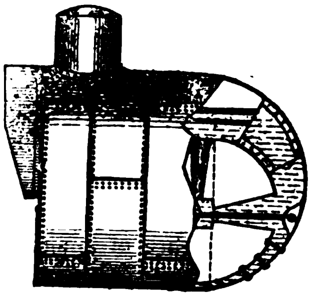
MESSRS. CHURCHILL'S PATENT UNIVERSAL MARINE ENGINE GOVERNOR

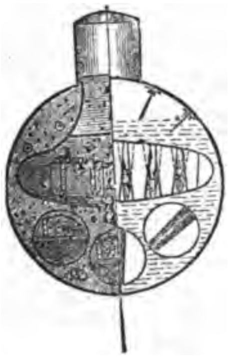
for compound and other engines is a very effective machine. It occupies a very limited space, it may be adjusted either vertically or horizontally, or in any other position to get the most direct lead to the throttle valve spindle. It is most simple in construction, perfectly noiseless, and can always be driven without crossing ropes or belts. It entirely prevents racing, and controls the engines to the greatest nicety. It has proved most satisfactory to many marine engineers who have adopted it. The minimum to which a perfect governor reduces the risks to shafting and machinery, by preventing racing in a heavy sea, is a most important factor, and should recommend this machine.



MR. T. F. PASSMAN, OF MIDDLESBOROUGH,

exhibits a marine boiler designed for the purpose of generating steam quickly, and maintaining it with the lowest possible consumption of fuel. The furnaces of this boiler are so connected with the combustion chamber that by firing each furnace alternately, and keeping one fire bright, it ignites the carbonaceous gases from the other furnaces as it passes through the combustion chamber to the return flue, thus maintaining a genial heat throughout the boiler flues, and obviating all unequal contractions and expansion. By this means the smoke otherwise resulting is entirely consumed.





THE PATENT JOINTING MANUFACTURING COMPANY, LIMITED,

exhibit a steam-joint compound of a most useful nature. A joint once made will last till intentionally broken, when the surfaces of the metals may be easily cleared of the particles of the old joint. It answers the same as white or red lead for a screw joint, and is of great advantage on account of the fact that joints can be made while a vessel is under weigh without causing delays.

THE GRAIGOLA MERTHYR PATENT FUEL.

This fuel is made from carefully-selected South Wales Coal, combined with bituminous matter, and compressed into rectangular blocks (9½ by 5½ by 5 inches) of extreme density. It raises steam with much greater rapidity than coal, and maintains its high evaporative power for a great length of time. It does not waste in any appreciable degree by exposure to the action of the atmosphere, and is of such a hard nature that the rough usage incidental to loading and discharging causes very little loss in dust and breakage. The stowage space occupied by these blocks is 20 per cent. less than coal, and they can be shipped amongst other goods without any danger of combustion. The two last named features is a strong recommendation on the part of this fuel to steamship companies and owners.

MESSRS. HIGGINSON & CO., OF LIVERPOOL,

show, amongst other specialities, a Patent Steam Quarter-Master and Noiseless Rotary Ash Hoist. The action of the machine composing the Patent Steam Quarter-Master is demonstrated by placing it on one of two bridges, the machine itself being placed on one and the connections carried to the one above, by means of which their steering arrangement may be worked from either bridge. Four different sizes of these machines are shown, to suit either a 1,200, 2,200, 3,300, or 4,400 ton vessel. The Steam Quarter-Master has been applied for the purpose of giving a complete governing power over the usual steering apparatus of a vessel, and at the same time considerably augmenting the speed with which the rudder may be put over. It is arranged for steering by hand as well as by steam, one motion only being necessary to make the change, viz., by simply moving a lever backwards or forwards.

The amount of helm is regulated to the greatest nicety by means of valve connections, worked automatically, which cuts off the steam directly the rudder is hard over. The short space of time occupied in moving the tiller from amidships to hard over is only five seconds, a point of the greatest importance in case of imminent danger.

The ease with which the heaviest vessel could be handled by one man with the Patent Steam Quarter-Master in the worst possible weather is one of its greatest recommendations. It is now extensively adopted by all our principal steamship companies, and should prove most useful on board all kinds of men-of-war.

The "Rotary Ash Hoist" is used for hoisting ashes from the stoke-holds of our large steamers. It is perfectly noiseless in its action, and effects a great saving of manual labour.

These are fitted to the Inman, Guion, and White Star Lines, and will in all probability be adopted by all large steamship owners. The Rotary Ash Hoist may be seen working under steam.

MR. ROBERT PICKWELL, OF HULL,

exhibits, what promises to become a highly important invention. This consists of a self-registering ship's compass, by means of which a diagram is produced showing the exact course steered, the length of time the ship has been kept on any course, all the changes of the courses, and the exact time at which such changes take place. The diagram is equally applicable to long or short voyages, and can be taken off and consulted daily, or be allowed to run the whole length of a voyage not exceeding 150 days.

The Compass itself is perfectly independent of the registering apparatus, which can be easily applied to any ordinary compass in general use. The great advantage of this instrument will at once commend it to all steamship companies and ship owners as the most perfect record of the working of any vessel, will always be at hand on the termination of a voyage, and would entirely stop any false entries in the log, as well as decide what course was being taken in case of a collision. The instrument, with diagrams, is exhibited at Stand No. 276.

LAUNCH OF THE "COLOSSUS."

THE double-turret ship *Colossus* was launched at Portsmouth on March 21st, from the same slipway down which, six years ago, the *Inflexible* glided into the water. The harbour squadron dressed in the early morning with masthead and over-head flags, while the dockyard and the ship itself were richly and profusely decorated. The Admiralty were largely represented on the occasion. Sir Thomas Brassey and the Controller of the Navy arrived in the *Enchantress* from Pembroke early on the previous morning; and later in the day Lord Northbrook (the First Lord of the Admiralty) and Lady Emma Baring, who performed the christening ceremony, Captain Hopkins (private secretary), Admiral Sir A. Cooper Key (Senior Sea Lord), and Admiral Hoskins (Junior Sea Lord) reached the town, the presence of the First Lord being announced on the morning of the launch by the hoisting of the Admiralty flag at the entrance of the dockyard and the firing of a salute from the *Duke of Wellington*. The ship was surrounded by a number of platforms, to which admission was gained by tickets, those at the stem and bows being gaily ornamented with flags and evergreens. On either side of the ship there were stands for the bands of the Royal Marine Artillery and Light Infantry Corps, which played alternately until the fall of the dogshores, when as the ship moved they united in playing "Rule Britannia." The crowd above and below was tremendous, the applications for tickets to Admiral Foley to view the launch being, with the exercise of the utmost possible economy as regards space, far beyond the amount of accommodation. Among the distinguished persons present were the present and the late First Lord, Prince and Princess Edward of Saxe-Weimar, the Duke of Richmond, Admirals Ryder, Chads, Fellows, and Lethbridge, Sir William and Lady Knighton, Lord Foley, and a large gathering of naval and military officers in uniform.

The whole of the arrangements connected with the launch were admirably devised and carried out, electricity being very extensively called into requisition. Not only was the ship "set up" and the "slices" driven home in the early morning under the illumination provided by the electric light, but the electric current was used to break the bottle against the stem, to cause the weights to fall upon the dogshores, to indicate the height of the tide, to announce the actual movement of the ship down the ways, and to put the musical box in operation which tinkled out the strains of "Rule Britannia," as the monster war machine backed away from the lady who performed the christening ceremony. The customary bottle of wine, which was concealed in flowers, was suspended on the top of a pillar of burnished gold, surmounted with a crown, and highly embellished with dolphins and mouldings forming a knotted rope. Fixed to the pillar was a plate inscribed with an engraving of the ship and the name of Lady Emma, to which were fitted the electric levers and buttons for letting go the bottle and causing the weights to fall which knock away the dogshores and relieve the ship. The musical instrument to which reference has been made was enclosed in a beautifully manufactured box of bird's-eye maple, having gold mouldings and inlaid panels, and was subsequently presented by Admiral Foley to Lady Emma Baring as a souvenir of the occasion. Twelve o'clock had been fixed for the launch, but as a matter of fact, the ship entered the water fully ten minutes before the appointed time. As the tide was suitable and the indications showed that she was ready to move, the proceedings at the supreme moment were somewhat hurried. The service was read by the Rev. Mr. Williams, immediately after which, at a signal from Mr. Owen, the chief constructor, the dogshores were knocked away, and the ship instantaneously, without so much as a perceptible pause, slid down the ways amid the most tumultuous cheering and waving of hats. No better launch has ever taken place at Portsmouth, and the greatest credit is due to Mr. Barnaby, the constructor, and to Mr. Coward, the foreman, under whom the ship was built and launched.

Although the load displacement of the *Inflexible* is as 11,980 tons to 9,160 tons of the *Colossus*, the latter is the heaviest ship which has ever been launched at Portsmouth, her actual moving weight at the time of launching being 500 tons in excess of the launching weight of the *Inflexible*, and within 300 tons of that of her sister ship, the *Edinburgh*, which was launched at Pembroke on Saturday. The difference between her and the *Inflexible* is due to the fact that the *Colossus* is in a more finished state than the former ship, having been advanced five-eighths towards completion. The fore and after ends of the citadel have also been completely armoured with 16-inch compressed plates, making a total of 1,290 tons. The prodigious weight of the hull necessitated special precautions being taken to enable the structure to support its own weight after the shores had been removed and before it had become buoyant on entering the water. Effective measures were also required to prevent any injury being done to the ship by sagging and local strains at the supremely critical moment when the stern becomes buoyant and lifts before the forward parts of the ship have left the ways. This temporary strengthening had taken place simultaneously with the progress of the monster, the double-bottom and decks having been effectually secured against collapse under pressure by a mass of diagonal and vertical shores. One of the most noticeable circumstances connected with the *Colossus* is the rapidity with which she has been constructed by Mr. Coward under the superintendence of Mr. R. Barnaby. The keel was laid on the 26th of July, 1879, and, although the transition through which naval guns were passing from muzzle to breech loaders, and the necessary modifications which required to be made in the turret and hydraulic fittings, materially retarded the work, only a little more than two years-and-a-half have intervened between her laying down and her launch.

The rapid progress of the *Colossus* is, doubtless, due in a great measure to the vigorous shipbuilding policy of the present Admiralty. At the same time, it must be pointed out that the ship is built upon the lines of the *Inflexible*, and that the many disputed issues which arose during the construction of the latter had been pretty well thrashed out through the means of a somewhat bitter controversy and the investigations of the committee which was subsequently appointed to report upon the whole subject. The air had been cleared, so that the *Colossus* was enabled to be pushed forward without any of the doubts and experiments which retarded the progress of the older ship.

But while the *Colossus* is in nearly all respects similar to the *Inflexible*, the turrets being moveable and placed on either side of the middle line, she combines many departures from her prototype. These will be easily perceived from the following table:—

	INFLEXIBLE.	COLOSSUS.
Length between perpendiculars	320 ft.	325 ft.
Breadth, extreme	75 ft.	68 ft.
Depth in hold...	23 ft. 3½ in.	24 ft. 7 in.
Displacement at load draught	11,980 tons	9,160 tons
Draught of water Forward	24 ft. 6 in.	25 ft. 3 in.
Draught of water Aft ...	26 ft. 6 in.	26 ft. 3 in.
Draught of water Mean ...	25 ft. 6 in.	25 ft. 9 in.
Indicated horse power ...	8,000	6,000
Estimated speed in knots ...	14	14
Complement of coal... ...	1,200 tons	950 tons
Complement of officers and men...	484	395
Armament:—		
In turrets	Four 80-ton M.L.R. Woolwich guns	Four 43-ton B.L.R. Armstrong guns
On superstructures	Eight 20 pr. saluting	Four 6 in. B.L.R.
Along sides	Six Nordenfelt	Ten Nordenfelt
In tops	Two Gatling	Two Gardner
Length of citadel	110 ft.	108 ft.
Thickness of armour:—	Iron	Steel-faced
On sides of citadel ...	Outer, 12 in. Inner, 8, 12, & 4 in.	18 in. and 14 in. None
On forward bulkhead	Outer, 12 in. Inner, 8, 10, & 4 in.	16 in. and 13 in. None
On after bulkhead ...	Outer, 12 in. Inner, 6, 10, & 4 in.	16 in. and 13 in. None
On turrets	O., 9 in. steel-faced I., 8 and 7 in. iron	16 in. and 14 in. None
Weight of hull at launching	3,460 tons.	3,956 tons
Draught when launched	7 ft. 4 in. forward 11 ft. 7 in. aft.	12 ft. 5 in. 17 ft. 1 in.
Weight of armour in place at time of launching	488 tons	1,290 tons

The principal differences between the *Inflexible* and the improved *Inflexible* relate to the co-efficients, construction, armament, and armour. While the load displacement of the *Colossus* is considerably less than her prototype, she is both longer and deeper, though with a diminished beam. She will have the same speed, with 2,000 less horse power; and while she will carry in her turrets four 43-ton guns, as compared with the 80-ton guns of the *Inflexible*, yet as the former will be breechloaders they will enable her to penetrate 22 inches of iron and 19 inches of steel. As Mr. Trevelyan last week remarked, the guns will send a chilled projectile through anything that floats, except a narrow belt on the water-line of a very few ships, "which it is 50 to 1 that a shot would never hit in battle." In addition to her turret-guns the *Colossus* differs from the *Inflexible* in the fact that she will carry on her superstructure four 6-inch breech-loading guns—namely, two forward and two aft—having a very complete and extensive range. Several Nordenfelt machine guns have also been arranged to fire from the superstructure and from ports in the captain's cabin in any and every direction. Whereas, again, the *Inflexible* was built entirely of iron, including, with the exception of the turrets, the whole of her armour, the *Colossus* has been constructed throughout entirely of steel; and as the scantlings have been reduced in size without loss of strength, there has been a corresponding saving of deadweight. What many regard as a structural defect—viz., the unarmoured ends of the *Inflexible*—has been servilely followed in the new ship. An armoured deck three inches in thickness protects the ship below the water-line, where it is not protected by the citadel, and under cover of which the steering-gear and magazines are placed. But the French, while retaining this deck plating, have also taken the precaution of defending the stability of their monitors by means of an armoured belt, the advantage of which in action is easily seen. The central parts of the ship are protected by Wilson's patent steel-faced armour of various thicknesses, the entire protection, however, whether on the side, citadel, or turrets, being of a single thickness. The total thickness of the sides is 3 feet, which is made up of a couple of strakes of teak backing, each 11 inches thick, and 14 inches of compound armour. For 18 inches above and the same depth below the water line the armour is 18 inches thick, after which it tapers off to 8 inches at about 6 feet below the water. Even should this enormous protection, however, be pierced by shot, the engines and boilers would remain untouched, for between them and the wall of the sides are a wing passage and the coal-bunkers. Above the water-line the citadel ends are protected by 13 inches of teak and 13 inches of armour, but at the water-line the backing is reduced to 10 inches, and the armour is increased to 16 inches. A very noticeable difference between the *Inflexible* and the *Colossus* is the absence in the *Colossus* of the raised, undulating, and peculiar form of the upper deck, which was adopted in the *Inflexible* to afford protection to the loading arrangements. In the new ship the surface of the deck will be comparatively level, the loading, which will be accomplished by hydraulic power, taking place in the citadel itself. These arrangements are the result of the change from muzzle to breech loaders. The hydraulic gear, which is being constructed by the Elswick firm, will be designed to raise a trough containing the ammunition and projectiles, and is fitted flush with the main deck. When the trough is elevated to its proper height to meet the lowered breech of the gun, impulse will be given to the rammer and the charge thrust into the chamber, after which the trough will descend and form part of the deck. The ship will be provided with two Whitehead torpedo tubes. These are placed on each side of the citadel under protection of the side armour, the projectiles being discharged above the water line. Instead of the armoured cross as fitted on board the *Inflexible*, a V shaped armour tower, 12 in. thick, will be erected. This will be connected to the lower portion of the hull by means of an armoured trunk 6 in. thick. The *Colossus* possesses cork belt coffer dams, and the Watts's water chambers, the purpose of which is to quell rolling, have also recently been fitted, those in the *Inflexible* having proved very satisfactory. Although supplied with a couple of masts, the turretship will not carry sail, the masts being mainly for the purpose of hoisting boats in and out. The after mast will be adapted to lift and stow second-class torpedo boats. No definite arrangements for the electric lighting of the ship have yet been made, but in all probability incandescent lamps will be used. A great boon will be afforded to the officers by the circumstance that the cabins are placed in the superstructure, where they will be well lighted and ventilated in all weathers. The bottom of the ship is coated on the starboard side with Dr. Sims's composition, and on the port side with that of the Maritime Company, usually known as Hay's composition. The propelling engines, nearly the whole of which with the boilers have been received at Portsmouth, are manufactured by Mrs. Maudslay, Sons, & Field. They consist of two sets of compound engines, with inverted cylinders, and will be placed in separate engine compartments, divided by the midship bulkhead, thus forming a set of starboard and port engines giving motion to their respective propellors. There is only one funnel. Immense pumping power, as well as Friedman's ejectors, will be provided to free the ship of water. After the launch, the *Colossus* was taken alongside the yard for survey, after which she will be placed in the fitting basin to receive her machinery.

COLD AIR REFRIGERATOR.

AS the importation of fresh beef, mutton, butter, &c., in the frozen state from the United States, Australia, and other countries, is exciting such universal attention we took the opportunity on Monday last, the 27th inst., to pay a visit, with other gentlemen, to the Royal Victoria Docks, where Messrs. J. & E. Hall, of Dartford and London, have lately put up, to the order of the London and St. Katherine's Docks Company, two of their Patent Cold Air Machines, capable of delivering 10,000 and 30,000 cubic feet of air per hour respectively. Amongst those present were Mr. Thomas Archer, Agent-General for Queensland; Sir F. Dillon Bell, Agent-General for New Zealand; Sir Alexander Galt, High Commissioner for Dominion of Canada; Sir Daniel Cooper, Mr. Henniker Heaton, Mr. Crowe, and others.

The installation is made in the vaults under the warehouses on the A jetty, the chambers eleven in number, and capable of holding 8,000 sheep, being of the full width of the vaults—viz., about 14 feet, and of a length varying from 26 to 39 feet.

They are constructed of double skin of 2½ battens, with air space between filled with hard wood shavings.

The large machine, which is of the newest design, is of sufficient power to work the eight chambers with which it is in connection, also allowing of several chambers being added in case of need.

The construction and working of the large machine —an illustration of which is appended (Fig. 1)—is as follows:—

The steam and compression cylinders are in direct line with each other, and placed on the top of the frame which is of the hollow-box form.

The expansion cylinder is at a lower level, but in line with the crank shaft. To a crosshead, in common with the steam and compression piston rods, is attached a vertical vibrating beam (the top of which is shown) its lower end being attached by a short link to the bottom of the frame.

At about one-third the distance down, the connecting-rod is attached, which thus works under the steam cylinder.

This arrangement has many advantages, such as long stroke for compression cylinder, long connecting-rod, absence of guides, economy of space, and relieving the crank shaft from a considerable amount of strain.

The expansion cylinder works on the crank shaft in the usual way, through crosshead, guides, and connecting-rod.

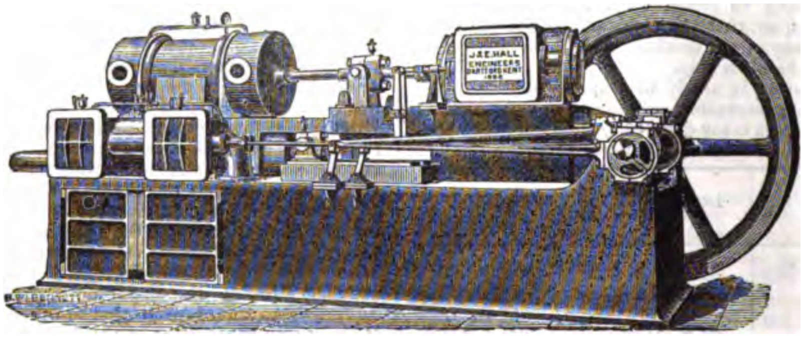


FIG. 1.

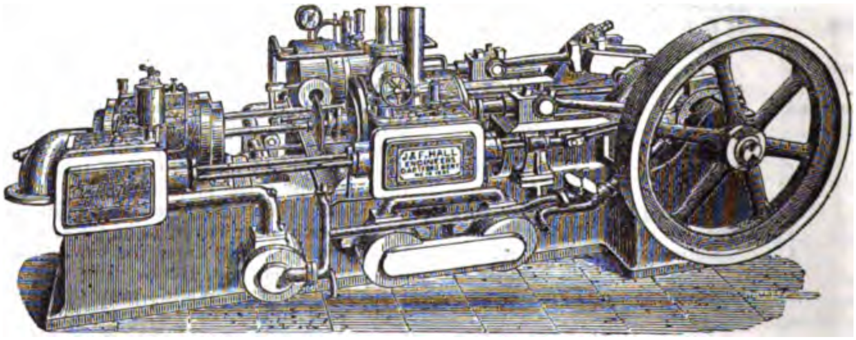


FIG. 2.

The air, after being drawn into the compression cylinder, gets compressed to about 55lbs. pressure, and increased in temperature by such compression to about 270 degrees F.; it is partly cooled by the circulating water round the cylinder which is water-jacketted, and passes away through two horizontal surface coolers, which reduce the temperature of the compressed air to within a few degrees of the temperature of the water. The cooled compressed air then enters the expansion cylinder, where it is expanded down to atmospheric pressure, and, in doing so, gives back useful work, passing it through the crank shaft to the compression cylinder.

The air, on leaving this cylinder, passes through a novel moisture and snow abstracter, and passes on its way to the chambers. The temperature of the air, on leaving the machine, is 102 degrees below zero, or 134 degrees of frost.

From the machine the air is delivered into a large wooden pipe running the whole length of the chambers, and so arranged that any one or more of them can be cooled simultaneously, the air, after passing through the chambers, being allowed to escape through self-acting valves.

At the time of our visit 1,700 sheep were being stored prior to being sent on the market, so we had abundant opportunity of examining them. They were of a very fine quality, and excellently preserved.

The smaller 10,000 cubic feet machine—an illustration of which we also append (Fig. 2)—is of an entirely different type to the large machine, though the principle of action is the same.

A machine similar to this, but with all the latest improvements, will be exhibited at work by Messrs. J. & E. Hall at the forthcoming Naval Exhibition, in connection with a freezing room similar to that used on board the Peninsular and Oriental Steam Navigation Company's new ships *Clyde*, *Sutlej*, and *Ganges*, which are provided with J. & E. Hall's machines for preserving ship's provisions, so enabling them not only to dispense with live stock, but to make their own ice and keep the drinking water, wines, butter, &c., cool during the hottest tropical weather. Two other ships—the *Ballarat* and *Paramatta*—belonging to the same company will also be fitted with these machines.

HER MAJESTY'S SHIP "POLYPHEMUS."

THE *Polyphemus*, double screw, armour-plated torpedo ram, 2,640 tons, 5,500-horse power, had trial trips on March 2nd, 4th, and 6th from Chatham. The vessel was in charge of Captain Lord Walter Kerr and the officers of the Medway Steam Reserve. The steam tug *Sampson* accompanied her to render assistance if required. Notwithstanding that the weather was very boisterous, the ship steamed through the water very steadily. The *Polyphemus* had left Sheerness for a short preliminary trial of her engines, and was passing the *Duncan*, flagship, when a mishap occurred in the engine-room which disabled the ship for ten minutes. The vessel drifted towards Garrison Point with the tide, which was running out very strongly, and for a short time was entirely beyond command. Fortunately the defect was soon remedied, when the *Polyphemus* steamed towards the Nore at a steady pace, closely followed by the *Sampson*. The speed was increased as soon as deep water was reached. Several runs were made, and the *Polyphemus* returned to the harbour at about four o'clock, when it was reported that the trial had been unsatisfactory on account of the priming of the engines, which at one time was so serious that the vessel had to be brought to. The average speed attained was eighteen knots. The *Polyphemus* anchored at the Medway entrance to Sheerness Harbour, when her compasses were adjusted by Captain May, the Admiralty hydrographer. The trial on March 4th was more satisfactory than on the first occasion. The ship was only tried at half speed, ten knots an hour being obtained. There was an absence of priming. In the afternoon the *Polyphemus* had her boilers pumped out, and took in 100 tons of fresh water. The *Polyphemus* again went out on March 6th for a trial of her engines and machinery on the measured mile, Maplin Sands. The trial was very unsatisfactory in consequence of the priming of the engines, and she returned to harbour sooner than was anticipated. The average speed was eighteen knots an hour.

The exceptional design and construction of the hull and equipment of the ram *Polyphemus* have been accompanied by equally exceptional novelties in the design and construction of her machinery, and the steam trials have been looked forward to with great interest and no little curiosity in engineering circles. The main departures from the ordinary type of engines have been carried out for the purpose of economizing weight and space; but other innovations have been sanctioned in consequence of the peculiar shape of the ship, the greater part of which is below the water-line, so that the use of forced blast is not only serviceable where sudden spurts of speed are required, but is a necessity of its existence. The engines have been manufactured by the well-known firm of Messrs. Humphreys & Tennant, of Deptford. They are of the horizontal, compound direct-acting type, driving twin screws, and are contracted to indicate a collective power of 5,500-horses. In their manufacture wrought iron, steel, and gun-metal have almost entirely superseded cast iron, whereby a great amount of deadweight has been saved, the whole of the power having been obtained on a total weight of 490 tons, including water in the boilers and a large quantity of work in connexion with the pumping arrangements not originally contemplated. The substitution of the locomotive description of boiler, with enclosed stoke-holes and forced draught, in lieu of the ordinary marine boiler is undoubtedly the innovation which first arrests the attention. To provide the requisite amount of steam, ten such boilers have been fitted, measuring 5ft. 3in. in diameter and 14ft. 4in. in length. The shells are constructed of steel, and the fire-boxes, &c., of iron. The boilers are placed athwartships, back to back, and are divided into four separate compartments, two of which contain three boilers each, while each of the others contains two. These compartments are enclosed, double doors providing the means of ingress and egress. The air for ventilation and draught is forced in by fans, worked by separate engines, the three-boiler compartments having each two 4ft-fans, and the two-boiler compartments a couple of 3ft. 6in. fans each. The engines which drive them have cylinders 9in. diameter, with a stroke of 4½ in. When going at full speed these fans make no fewer than from 900 to 1,000 revolutions per minute, and a pressure of air can be maintained equal to 6in. of water. In lieu of the ordinary feed arrangements from the main engines, each boiler compartment is provided with two separate pairs of feed engines, having separate suction and delivery pipes, so that the engineer may have perfect control of the water supply to the boilers under his charge. The fire-box doors are designed as in the case of torpedo boat boilers—the *Polyphemus* being, in fact, a colossal torpedo craft—and are arranged so that in the event of a tube giving out the steam will be prevented from finding its way into the stoke-hole. Many minor improvements have been introduced into the boiler fittings. The uptakes from the whole of the boilers converge into one funnel.

The high-pressure cylinders are 38 in., and the low-pressure cylinders 64 in. in diameter, with a stroke of 3 ft. 3 in. When exerting their *maximum* power, the engines make 120 revolutions per minute, which is equal to a speed of piston of 780 ft. Notwithstanding this enormous rapidity, no difficulty has been experienced in keeping the bearings quite cool, but ample means of lubrication have been fitted. With the exception of the stern-shafts the whole of the shafting is made of Whitworth's hollow compressed steel. In order to secure the best use of the restricted space available for the engines, the condensing apparatus, which is entirely composed of gun-metal, is placed at the back of the cylinders. By this arrangement the working parts are very accessible, while additional space has been provided for the starting-platform, &c. When going into action the engine-rooms would be enclosed like the stoke-holes, and care has consequently been taken to insure efficient ventilation by forcing air into and exhausting the vitiated air from the engine-room by means of ventilating and exhaust fans. The pumping arrangements for keeping the vessel free from water, even when much damaged, are very complete. In addition to the ordinary bilge pumps, which are worked direct off the main engines, the centrifugal pumps which are used for circulating the water through the surface-condensers are provided with a separate discharge from the bilge overboard, without passing through the condensers. There are also three centrifugal bilge pumps placed in the inner skin of the vessel. These pumps are actuated by separate small pairs of engines fixed high up under the steel turtle deck, so as to be instantaneously available when required, and kept free from any danger of being overwhelmed by a sudden inrush of water. The two fire-pumps are also made available for pumping out purposes, being fitted with separate bilge connections, so that it would be difficult to imagine any quantity of water getting into the vessel, either by accident or through the ship being damaged by shot, which could not be easily controlled by the pumping arrangements provided.

THE Messageries Company has four steamers, of 3,000 tons and 600-horse power, building at La Ciotat for its new Australian line. They will be named the *Melbourne*, *Caledonian*, *Sydney*, and *Salasié*.

Reviews.

Experimental Researches into the Properties and Motions of Fluids, with Theoretical Deductions therefrom. By W. F. Stanley. Published by E. & F. N. Spon.

Comparing the researches and deductions of the author with other well-known authorities on wave motions and wave resistances, it will be seen how carefully his experiments have been conducted, and how valuable they are as a confirmation of the results produced by others.

Figs. 1, 2, 3, and 4 shew the resistances and effects produced by forcing bodies through the water at different speeds. Mr. Stanley says, "Let the equal lines surrounding the solid, represented as in the model boat, Fig. 1, be of one yard in length, then the conic resistance of the boat may be assumed to press back the liquid to this line so that there will be an area of compression, represented by the dotted line, surrounding the boat in its horizontal plane at one yard distance—the resistances being assumed all equal—the surface water would be pressed back and elevated by the compression at this distance."

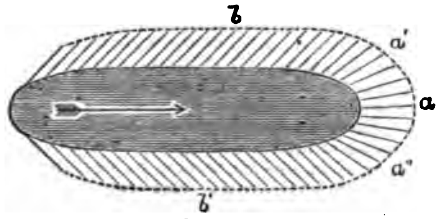


FIG. 1.

Again, in Fig. 2, the author assumes that all resistances will equally take direction of forty-five degrees as one angle of resistance. Thus:—"Let AA' represent the surface of the water; BB' a line below the surface; and CC' a line at an equal distance deeper in the water. Now, taking the same angle of forty-five degrees as before, about this line and the same lengths or radii; the pressing force from adhesion to the plane BB' may be assumed to be upwards and downwards."

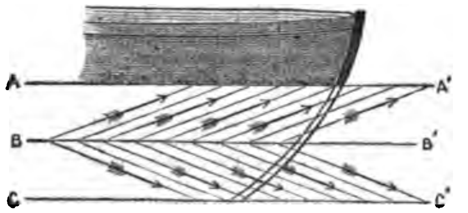


FIG. 2.

From the foregoing the author concludes that the deflection of the water caused by the projectile force of the boat would thrust the plane of direction outwards and upwards.

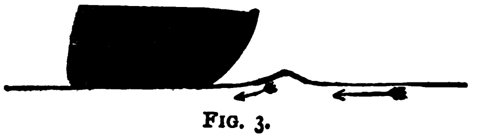


FIG. 3.

Fig. 3 shows the deflection produced in front of the boat, and Fig. 4 shows the generation of the wave system.

At the conclusion of the chapter Mr. Stanley regrets that his opportunities would not permit him to follow the matter of free solids in infinite fluids to a further extent, and expressing his intention at some future period to extend his observations in this direction by taking a sea voyage for this purpose. It is to be regretted that the author, whilst carrying out his experiments, and working up to theories, did not consult the works and results of others in this direction, as he would have been spared an infinite amount of useless labour, and thus allowed to devote his energies to the consideration of the fluid state in a much higher stage than the elementary portions he worked out so carefully unassisted.

Mr. J. Scott Russell, in Vol. I. of the "Transactions of the Institution of Naval Architects," contributed two papers on *The Wave-like Principle of Ship Construction*, in which he showed the effects of the wave line upon the stability of ships, and on the area of the load water line; how it affected the structure of the vessel; how vessels should be built upon a principle so as to have a maximum capacity which it appears to militate against; how the various proportions of length, depth and breadth affect resistance; how the wave principle affects the navigable qualities of the ship, &c., &c. These papers and those following up the subject by the same author, with the able discussions fully recorded in the different volumes of this institution, show the amount of study and care that had been expended in arriving at various established theories, and the nicety to which they could be applied.

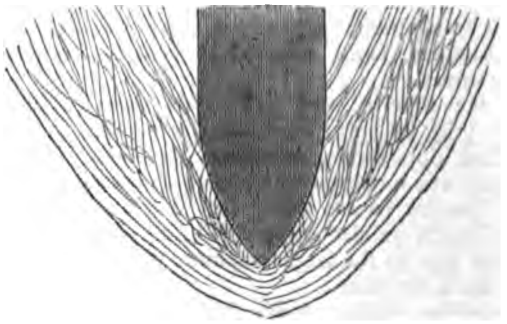


FIG. 4.

As regards the system of rolling contact of particles of water on themselves and on other bodies, Mr. Stanley has well and carefully worked out experiments proving the theories already in existence, and in an advanced stage of development. Mr. J. Scott Russell, Dr. Woolley, Mr. W. Froude, J. Macquorn Rankine, Mons. L. E. Bertin, and many other well-known investigators of the state and conditions of fluids under varied circumstances, all agree that particles of water act on each other with a rolling motion, as well as on solid bodies; likewise, that waves generated by different means are made up of innumerable particles with this rolling motion on each other, which imparts circular and concave forms to waves, and likewise causes the circular formation to eddies, currents, &c., &c. It is not recorded that from the action of particles of water on each other any other author has yet worked to the whirl and bi-whirl systems of our large oceans, but the subject is most interesting and worthy of development.

The work, as a whole, is a carefully worked out exposition of the laws and actions of fluids, and is most valuable to all students. Mr. Stanley has for years, from his own ideas, worked out a succession of experiments of the most useful nature, from which any student of natural laws and forces could glean an amount of knowledge and instruction not to be obtained from any other ordinary work on this subject. Mr. Stanley signifies his intention of extending his experiments and completing his theories to the fullest possible extent. Should he carry out his intention, and give the benefit of his researches in the shape of a similar volume in addition to the present, it would be hailed as a valuable completion to the present useful work.

OUR ROYAL MARINE ENGINEERS AND ENGINE-ROOM ARTIFICERS.

(*Continued from page* 246).

THE position held by the royal marine engineer in our Navy has been greatly improved of late years, placing them on an equality with commissioned officers in nearly every respect. Their cabin accommodation has been considerably increased, they are allowed servants and attendants, and are entirely relieved from the necessity of carrying out any manual labour in connection with their profession by the introduction of the engine-room artificer into the service. As regards the cabin accommodation, any one possessing any knowledge of the confined space which answered the purpose of living room, dressing room, bath room, and office to the staff of engineers, excepting the chief engineer, in the early days of steam navigation in our wooden men-of-war, cannot but be struck with the great improvements which have been made in this direction. In former days the cabin accommodation was of the most limited kind, the engineers who came off watch would frequently be as dirty and greasy as any of the stokers, on account of the actual part they were then called upon to take in the working of the engines, they would have an apology for a bath as far as their cramped quarters would allow, then have whatever meal the time of day necessitated, and after that, make up any reports or entries of ordinary routine.

At turn-in time, these engineers slept in hammocks slung to the beams outside of their cabin, which was frequently in close proximity to the mess tables and hammocks of the crew located on the lower deck. Their dressing and undressing operations would be conducted in as rapid a manner as possible, entirely in public, as far as the crew were concerned.

Their ordinary diet was very little above the messing arrangements of the crew, in fact they were not nearly so well situated and provided for at the time referred to as the engine-room artificers of the present day. Bearing these facts in mind, what a highly improved position in this direction we find the royal marine engineers of the present day occupying. Our men-of-war are now fitted with an engineers' ward, or mess room, engineers' cabins, engineers' lavatories and bath rooms, engineers' pantry, and stewards' cabin, and they are at least allowed a steward and a cook by the regulations of the service, whilst a considerable portion of the galley is devoted to the cooking and dishing up every kind of delicacy for their table. Instead of sleeping in hammocks, very little removed from the crew, they have comfortable bed berths in their different cabins with every arrangement for comfort and privacy.

As regards cleansing and changing clothing, this is not such a necessary operation with the royal marine engineer of the present day as it was in days gone by. An engineer presenting now the grimy hands and face, the soiled and defaced uniform, and the general hard-worked appearance of engineers of former days would, indeed, be a novelty. The engineer of the present day might go on duty as well attired in every respect as engineers of former days, would dress themselves on special occasions, such as on general inspection days or going on shore; and come off duty the same as they went on. Withal they are provided with the greatest convenience as regards bath and dressing rooms. From the accounts of the development of our royal marine engineers given in our issues for January and February of the present year, the following summary of their position and status as compared with commissioned officers is clearly shown. The engineer student of the present day is educated by the Government during his apprenticeship. Whilst undergoing his different courses of instruction he wears a uniform of blue cloth and gilt buttons, very similar to that of a midshipman, and is trained on board a man-of-war set apart for this purpose. At the termination of his apprenticeship, on entering the Navy as a royal marine engineer, he dons a full uniform, becomes the possessor of a bed cabin, has the use of the engineers' dining room in common with the others composing the staff, and generally has a stoker attached to him as his servant. His duties are of a gentlemanly nature, in that they consist chiefly of giving directions to the engine-room artificers and stokers, and as a full staff is allowed in the service, the royal marine engineer is not overworked.

The commissioned officer of our Royal Navy is educated as a cadet and midshipman in much the same manner as a gentleman apprentice. When they pass out of this grade to that of a sub-lieutenant, they dress in a fuller uniform, very similar to the royal marine engineer when out of his apprenticeship. The midshipmen and sub-lieutenants do duty both on deck and aloft, but of such a nature that their uniforms are not usually defaced or destroyed.

The 1st, 2nd, 3rd, and 4th lieutenants have sleeping cabins, the use of the commissioned officers' mess room, lavatories and baths, they have their cook and steward, pantry and stewards' room, and have generally each a marine to act as a servant to them.

The only difference to be observed then in the position of our royal marine engineers as compared with commissoned officers, is, that the engineer does duty below decks, and the commissioned officer above deck.

As far as their position in the ship as officers, whose status and comfort should be studied is concerned, it is difficult to see that any distinction is made between them. In a future issue we purpose noticing the pay of our royal marine engineers.

(*To be continued.*)

A TORPEDO course, lasting about two months, will commence on board the *Vernon* on the 12th of April, at 9 a.m., to which naval officers on half-pay will be admitted. Any officers wishing to join it should make application to the Secretary of the Admiralty not later than the end of March, stating if they require accommodation at the college,

INSTITUTE OF NAVAL ARCHITECTS.

THE Session of this Institute was opened on March 29th at the hall of the Society of Arts in London, when the inaugural address was delivered by the Earl of Ravensworth, the President. The meeting was largely attended.

The President said they had never yet witnessed such development in the shipbuilding industries as had been brought under their notice during recent years. In that period the greatest activity had been displayed, and although some had felt that they were overbuilding, yet the trade had been well sustained. We were bound to maintain our position as ocean carriers, and to do so against all comers, and at any cost. In fact, he hoped that the shipbuilding trade would be still further improved in position. It was not enough for a nation like England to build ships, but she must build the best ships if she meant to maintain her position. He desired here to refer to another important branch in which great progress had been made; he meant in the department of marine engineering. The progress in this branch was not less marvellous than in shipbuilding, and the saving effected was something remarkable. Of course, the great desire of all was to economise fuel. He resided in a large colliery district, and he confessed that he had grave misgivings about the waste of coal, and the apathy in the public mind, not only in private houses, but in manufactories, on the subject. During the nine years up to 1872 the improvements in marine engineering were so vast that the consumption was reduced by one-half. Since that time, by the use of combined engines, a saving of 13 per cent. was effected, and subsequently, by the introduction of the triple engine, a further saving had been made of 12 per cent., making altogether a total saving of 75 per cent. These economies were most important, because the increased pressure meant increased speed, increased carrying capacity, and, consequently, increased freight-earning power, for the ship that burnt the least would inevitably, in the long run, earn the most. He hoped the Tyne and Clyde, who had made so many experiments in this direction, might, in the long run, share in the advantages which would result. in the same way as they were entitled to share in the credit of the improvements. He had mentioned the exceeding activity which had characterized the shipbuilding trade during the last year, and he was justified, after a careful examination of the figures, in saying that the output during the last twelvemonths had greatly exceeded that of any similar period. The Clyde stood at the head of the list as usual, and his own river—the Tyne—came next. The Clyde showed an increase of 98,000 tons in 1881 over 1880, there having been 343,823 tons of shipping built there. That, he might say, was an unprecedented total for any single port. There were on the Clyde forty establishments engaged in shipbuilding. The north-eastern ports, which comprised Blyth, Tyne, Wear, Tees, Whitby, and West Hartlepool, had 39 established shipbuilding yards, namely:—Tyne, 16; Wear, 13; Tees, four; West Hartlepool, three; Blyth, two; Whitby, one—and these 39 firms turned out during the last year 292 vessels, with a total tonnage of 456,236, against the 269 vessels on the Clyde with a tonnage of 343,823, built by the 40 firms there, so that the output of the north-eastern ports was 23 vessels and a tonnage of 153,413 more than that of the Clyde. He should like to direct attention to one fact. There was one firm on the Tyne, Messrs. Palmer's, who turned out no less an output than 50,492 tons of iron shipping, an amount wholly unprecedented in any single establishment, and that in spite of the bad weather in the early part of the year, which in three months stopped work for half that time. There was another port, namely, Barrow, which he could not overlook. Only a little time ago it was unknown, but now there was a company there which stood second only to the great establishment of Messrs. Palmer, their output during the year 1881 having been 32,700 tons. Last year he could remember they were talking about the magnificent ship *Servia*, of 8,500 tons, and, to show the advances which had been made, he might mention that hardly six months had elapsed before the *City of Rome* was launched from Barrow, a ship of 8,800 tons. Talking of the advance which had been made, he noticed that the *Stirling Castle* had actually performed at sea, with a dead weight of 3,000 tons, 18½ knots in an hour. These results were quite sufficient, he thought, to justify him in saying that the shipbuilding trade was being very largely and rapidly developed, and the information which reached him from all sides pointed to the fact that the activity was not over. He hardly knew in any of these great establishments in his part of the country a berth vacant, and he was sure the greatest difficulty would be experienced in placing a contract. That was a most satisfactory state of things, and he believed he might say that whilst they turned out in the aggregate last year a million tons, at this moment there was in course of building or under contract to be built, another million tons this year. Sir William Armstrong, in his Presidential address to the Civil Engineers' Society, in January, directed attention to the war ship of the future, and Mr. William Denny, in a lecture since delivered, had spoken of the merchant vessel of the future. There was a close and interesting convergence of view between these eminent men upon one point particularly, and that was moderation—moderation of size and moderation of cost. Sir William Armstrong said that with regard to the danger of ironclad as against unarmoured vessels to be sunk there was much less difference than was supposed, and he believed that an unarmoured ship might be built which it would be impossible to sink. The same authority said that for the cost of one ironclad three unarmoured ships might be built, with greater speed, and, to put it boldly, better vessels. Then Mr. Denny expressed a belief that there would be a reaction in the vessels which were carrying our merchandise and passengers, and that length would give way to increased breadth of beam. That authority also spoke of the necessity for speed, and suggested that the vessels should be built of steel. All this pointed to one end, and he was glad to hear Mr. Trevelyan, when introducing the Navy Estimates, say that the Admiralty had carried out their intention not to build great and costly ships, or ships of great variety. He considered that when they had once got the right type of ship, they should be produced in sufficient numbers, and it was a very good warning to the taxpayers of England that the period of experiments was over. He hoped we were merging from an experimental period to within what he might, to use a classical phrase, term a "measurable distance" when we might, with equal pride and satisfaction, point to a particular type and say that was the accepted type—that was the useful, manageable, safe, serviceable ship of the future.

The meeting then proceeded to discuss papers on the programme.

* CORROSIVE EFFECTS OF STEEL ON IRON IN SALT WATER.

By J. FARQUHARSON, Esq.

AT the meeting of this Institution last year attention was drawn to this subject, and some particulars furnished of actual cases of rapid corrosion. The facts then stated were rather suggestive than conclusive that its origin was the steel combination, as there are other known causes of equally rapid corrosion where no steel is present. Large iron forgings, besides being liable to external influences, contain within themselves elements of decay as rapid as any then noticed. Such forgings are made up of numerous smaller ones, and after being welded up into one whole they contain more or less magnetic oxide, which is as destructive as a like quantity of copper would be if placed in its stead; the well-know fissures or deep seams, which appear more or less in all rolled or forged iron when corroded by salt water, are wholly due to this cause; these fissures bear in direction a certain relation to one another, by which they are readily known when the actual case is before us, but not otherwise. Although the Admiralty practice does not involve combinations of iron and steel to any great extent, the question raised last year was considered of sufficient importance to test by actual experiments the results of which I am now permitted to bring before you. Before doing so, in order that the basis of the experiment may be clearly understood, it may be well to notice, briefly, another experiment, made two or three years ago for the purpose of testing the effects of surface oxide or scale on rolled mild steel. The two points which that experiment was designed to ascertain were, first, the amount of injury by pitting which the scale might cause in a given time when portions of the surface are unprotected by such scale; secondly, whether such scale action is likely to be permanent. The result went to show that there is practically no diminution at the end of six months' immersion in salt water; steel plates completely covered by scale in combination with a similar steel plate without scale in some cases did not lose a single grain in weight; second, the loss of weight or work done by steel oxide was found to be rather more than from a plate of copper of the same size. The experiment now about to be described was therefore undertaken with a full knowledge of these results, which account for much of the confusion and misapprehension which have arisen in cases where scale was neglected, and which show that in any case intended to test relative corrosion of metals, surface scale or oxide must not be neglected; that care must be taken that the materials used are iron and steel and nothing else, and that the surfaces be large enough to give a good average result. In the present case, plates of iron and steel of equal size, with an aggregate surface of 48 superficial feet, were used. After having the scale completely removed by dilute hydrochloric acid, they were singly weighed, marked, and placed in a grooved wooden frame, parallel and one inch apart, iron and steel alternately. The first, third, and fifth pairs were electrically combined by straps of iron at the tops; the second, fourth, and sixth pairs being left unconnected, and therefore each plate of which was only subject to ordinary corrosion, as if no other metal existed. The whole series so arranged were placed in Portsmouth Harbour, and left undisturbed for six months, when they were taken up and again weighed. The loss of each plate was found to be as under:—

		oz.	grs.			ozs.	grs.
Steel	combined	0	427	Steel . . .		4	0
Iron		7	417	Iron . . .		3	190
Steel . .		3	340	Steel	combined	2	337
Iron . . .		3	327	Iron		6	0
Steel	combined	0	297	Steel . . .		4	157
Iron		7	77	Iron . . .		4	57

From the above it will be seen that the three iron plates combined with steel lost 21 oz. 57 grs.; that the three similar iron plates not combined lost only 11 oz. 137 grs. The plates were identical in size, and all cut from the same sheet, the effect of combination with steel being to nearly double the loss of weight. The proof that the great excess of loss was not due to anything in the plates themselves will be clearly seen by comparing the combined and uncombined steel plates thus:—The three combined with iron lost only 4 ozs. 187 grs.; the three uncombined lost 12 oz. 60 grs., or nearly three times as much as those protected electrically by the iron. These two facts taken together, viz., iron combined with steel invariably lost more, and that steel so combined lost less, prove to a demonstration that electrical action existed. The difference in such loss of weight is a measure of the amount of such action from which it would be easy to draw wrong conclusions; one thing may be inferred, viz., that in this particular case about two-thirds of the electrical energy of the combination was given up in reducing the metal, and the other one third in the intervening liquid; taking the distance apart into consideration, it will be seen that the energy was considerable. The laws of of electro-chemical action are brief, simple, and invariable, but the results are so modified by conditions which interfere in practice that a clear appreciation of them is necessary in each particular case. It would not be safe to infer that if these plates had only been one-fourth the distance apart the loss would have followed the well known law, because in such a case it is probable that the action would soon have been arrested by the formation of rust between the plates; on the other hand, if the iron plates had been protected, except a patch in the middle by waterproof material, all other things remaining the same, it is quite certain that the result would have been serious injury to the plate by pitting of the exposed part on which a very large portion of the energy in such a case would be concentrated. Again, had the plates been placed edge to edge and contact maintained, the iron

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* Read at the Twenty-third Session of the Institute of Naval Architects, March 30th, 1882; the Right Hon. the Earl of Ravensworth, President, in the Chair.

would certainly have suffered much on the edge next the steel. Before leaving this part of the subject a word of explanation with reference to a difference which may be noticed in the relative loss of the third pair of combined plates is necessary, in which case the steel lost more and the iron less than in other similar pairs; the probable cause of this is that the connection at the top was less perfect than it should have been, and that in consequence rust formed between the connecting strap and the plate, which after a time arrested the electrical energy and reduced it to a case of simple corrosion. With this exception, which is not a large one, the results are fairly uniform, when judged in the light of local influences which may exist in the individual plates.

The main object of this experiment was to test the effects of combinations of iron and steel, and the lesson taught is to either avoid altogether such combinations or to take care to so modify the conditions as to minimise the injury to the iron, but you will observe that the arrangements in this experiment are such that the results may throw some light on a still more important question, viz., the relative endurance of iron and steel when freed from injurious combinations. The already extensive and still growing use of steel makes this a matter of very great importance. Assuming that the unconnected plates of steel and iron represent the normal loss of each under ordinary and equal conditions, they approximate so closely that the endurance may be considered as practically the same, and this result agrees with that obtained from other and more extensive tests previously made for the Admiralty, and which formed the basis and justification of the use of steel instead of iron in naval construction; in the present experiment the unconnected plates had an aggregate surface of 12 superficial feet each metal. The total loss of weight was—iron, 11 ozs. 137 grs.; steel, 12 ozs. 60 grs.; difference in favour of iron on the whole surface 360 grains weight, or 30 grains per foot superficial, which is inconsiderable. A careful examination of the steel plates in this and other cases after immersion convinces me that these results (satisfactory as they may be when taken in conjunction with the other advantages of steel) are neither as good as they might be, or as they would be, if the importance of uniformity were recognized and the ingredients thoroughly mixed, as they should be, in the process of manufacture. In almost every plate there are evidences of local action between one portion and another—a sure indication that the manganese is not evenly diffused throughout. The plates used in this experiment are here, and we advise all interested to examine them and judge for themselves. In a former case in which the surfaces before immersion had been finished bright by fine filing, the marks could be seen after six months on some parts, whilst other parts of the same plate was corroded. In the present case the plates were not so prepared, but there are equally clear evidences of the facts observable. I commend this matter to the attention of steel makers and steel users, who are both interested. It has been said that manganese is difficult of diffusion, but if its importance as effecting the durability of the steel is recognised, means would soon be found to improve it. Knowing the facts stated above, on a recent visit to steel works I took careful note of the practice which was as follows: The furnace was tapped, and as soon as the molten steel began to run into the ladle, two men, with a shovel each, began to throw the ferro-manganese into the ladle, and this they continued to do until the steel was all in; no steps whatever were taken to mix by stirring or agitation. In such a process the wonder is that the results are no worse than they are found to be. When the ingredients are thoroughly mixed, there is good reason to believe that the endurance of steel, as regards corrosion, will not only be equal to the best iron but far superior, as it ought to be, and the time may not be far distant when consumers may find a ready means of detecting inequalities which will help to secure attention to this important matter.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Marion Lee.—On February 20th there was launched from the yard of the Whitehaven Shipbuilding Company a screw steamer, named the *Marion Lee*, built to the order of a lately-formed Shipping Company, of which Captain Gambles, of Harrington, is manager. The vessel is 650 tons register, and her dimensions are as follows:—Length, 193 ft.; breadth, 28 ft. 3 in.; depth, 15 ft. 4 in. The vessel, which is intended for the general trade, is fitted with all the recent improvements. The christening ceremony was performed by Miss Marion Lee Gambles, daughter of Captain Gambles.

George Heaton.—On February 20th there was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), of Willington Quay, on Tyne, an iron screw steamer of the following dimensions, viz.:—Length between perpendiculars, 285 ft.; breadth 37 ft.; and depth, 24 ft. 6 in. The vessel has been built to the order of Messrs. Charles Tully & Co, of Newcastle-on-Tyne, and is named *George Heaton*. Her engines are supplied by Messrs. R. & W. Hawthorn, of Newcastle-on-Tyne, and are of 200-horse power.

Recta.—On February 21st Messrs. Joseph L. Thompson & Sons launched from their shipbuilding-yard, North Sands, Sunderland, an iron screw steamer named the *Recta*, of about 4,000 tons cargo, and over 6,000 tons displacement. She is a spar-decked vessel, built to the highest class, 100 A 1 at Lloyd's, and will be fitted with a pair of engines of 230-horse power nominal, which are on the compound surface-condensing principle, having all the latest improvements in marine engineering.

Deer Hill.—On February 22nd Messrs. Wm. Gray & Co., West Hartlepool, launched the first of three large steamers now building for Messrs. J. H. Murrell & Co., of Hartlepool East. Her principle dimensions are:—256·6 by 34·6 by 19·8 to floors. She will carry about 2,400 tons, is fitted up with every modern appliance, and is classed A 100 at Lloyd's. As she left the ways she was christened the *Deer Hill* by Mrs. J. H. Murrell, wife of the managing owner. The engines of 150-horse power will be fitted by Blair & Co. (Limited), and the boilers will be furnished with Fox's corrugated furnaces.

Highgate.—On March 4th an iron screw steamer, built to the special order of the London firm of Messrs. Turnbull, Scott & Co., was launched on the Esk at Whitby. She was christened *Highgate* by Mrs. Debenham, of London. The dimensions of the vessel are:—Length, 240 ft.; breadth, 34 ft.; depth of hold, 17 ft. 9 in. She is classed 100 A 1 at Lloyd's under special survey. Her engines are by Messrs. Richardson & Sons, and are 130-horse power nominal.

Mareca.—On March 4th the screw steamer *Mareca*, built for Messrs. Porteous & Senior, London, was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Company (Limited). The dimensions of the vessel are:—Length, 300 ft.; breadth, 37 ft.; depth, 24½ ft.; carrying capacity, deadweight, 3,300 tons.

Langdon.—On March 6th there was launched from the iron shipbuilding-yard of Messrs. John Readhead & Co., South Shields, a steamer of the following dimensions:—240 ft. by 34 ft. by 18 ft., built to the order of Messrs. John Fenwick & Son, Gracechurch-street, London, and fitted with all the latest improvements. The engines, which are 130-horse power, are built by J. Readhead & Co. As she left the ways she was named the *Langdon*, by Miss Thompson, of Tyne Dock.

Ehrenfels.—On March 7th the *Ehrenfels*, for the Hansa Steam Navigation Company, of Bremen, was launched by Messrs. Wigham Richardson & Co., from the Neptune Works, on the Tyne. The christening ceremony was performed by Mrs. G. L. Abegg. This steamer, of 2,293 registered tons and 350-horse power, and fitted up to the requirements of the Board of Trade for passengers, was built to the order of Messrs. Stumore, Weston, & Co. The *Ehrenfels* will be commanded by Captain Fischer, of the *Nord Deutscher Lloyd*. She is now under the shears taking in her machinery, which has also been constructed by Messrs. Wigham Richardson & Co.

Benacre.—On March 7th Messrs. Caird & Purdie, Barrow-in-Furness, launched a steamer of about 2,000 tons, built to the order of Mr. Joseph Holt, of Liverpool. On leaving the ways the ceremony of christening the steamer *Benacre* was performed by Mrs. Gardner, wife of Mr. J. S. Gardner, of The Rocklands, Thornton Hough. The new steamer will be fitted with powerful machinery made by Mr. W. Kemp, Govan, and will have all the latest improvements for rapid and economical working.

Hildegarde.—On March 7th there was launched from the Howden yard of the Palmer's Shipbuilding and Iron Company (Limited) a screw steamer bearing the above name, and of about 2,750 tons carrying capacity. This steamer has been built under special survey, and to the highest requirements of Lloyd's, 100 A 1 class. She will be finished throughout in the most substantial and complete manner, and fitted with every modern appliance for rapid discharge and re-loading, as also for economy in every detail of working. She will be employed in the general carrying trade. The steamer is the fourth built by the Palmer's Company to the order of Messrs. J. and R. Bovey, of London and Cardiff, and the christening ceremony was performed by Mrs. Robert Bovey, the wife of one of the managing owners. A special feature in the steamers managed by the above firm is that each steamer is registered, under the Companies' Acts, as the property of a limited company. This fourth steamer will be registered as the property of the Hildegarde Steamship Company (Limited). Messrs. J. and R. Bovey have also contracted with the same builders for two more steamers of about 2,450 tons deadweight capacity, and suitable for Atlantic, Mediterranean, or Indian trades.

Gidion.—On March 8th Messrs. M'Intyre, of Paisley, launched from their yard an iron screw steamer, built to the order of Messrs. Pile & Co., of London and Glasgow. The vessel was named the *Gidion*, and her principal particulars are as follows:—Length, 180 ft.; breadth, 26 ft.; and depth, 13 ft. Built to class 100 A 1 at Lloyd's; full poop, bridge, and forecastle; compound engines of 70-horse power.

Australia.– Iron cutter, of about 220 tons gross, classed 100 A 1, length, 135 ft.; breadth, 22 ft.; depth, 11 ft.; built to the order of the Hull Steam Fishing and Ice Company (Limited), was launched from the works of Earle's Shipbuilding and Engineering Company, on the 11th March. She is fitted with compound screw engines, 60 nominal horse power, cylinders 21 in. by 40 in. diameter, 27 in. stroke. The vessel is intended for carrying fish from the fishing fleet to the port of Hull, and is the sixth vessel of the type built by Earle's Company for Hull owners.

Lymington—On March 11th there was launched by Messrs. Edwards & Symes the screw steamer *Lymington* of 172 tons burthen which has been built to the order of Messrs. Pile & Co. of London. She was christened as she left the ways by Mrs. Blake, wife of the Captain of the vessel.

Ashton.—On March 18th, Messrs. E. Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Mr. Williamson Lamplough, of London. Her principal dimensions are:—Length between perpendiculars, 257 ft. 6 in.; beam, extreme, 34 ft. 6 in.; depth, moulded, 20 ft. 4½ in. She has top-gallant forecastle, bridge-house, long quarter-deck, and short poop for the cabin; double bottom all fore-and-aft for water ballast, constructed on the cellular principle. The decks, chart-house, engine skylight, cabin companion, and skylight, are built of iron. She will be fitted with four steam winches and donkey boiler, and will be rigged as a double topsail schooner. She has been built under Lloyd's special survey for the 100 A 1 class, and under the superintendence of Captain Turner, her future commander. Engines of 150 nominal horse power will be fitted by Messrs. Black, Hawthorn & Co., of Gateshead-on-Tyne. She will be principally engaged in the Eastern trades. On leaving the ways the steamer was christened *Ashton* by Miss J. S. Lamplough.

Engineer.—On March 18th Messrs. Aitken & Mansel launched from their Whiteinch yard a screw steamer of about 2,700 tons register, fitted for the Eastern and Atlantic trades. Her machinery, which will be of 400-horse power, will be supplied by Messrs. John & James Thomson. The vessel was named the *Engineer* by Miss Mansel, daughter of one of the builders.

Longueil.—On March 18th, Messrs. William Pickersgill & Sons launched from their shipbuilding-yard, Southwick, Sunderland, an iron screw steamer for Messrs. Morel Brothers & Co., of Cardiff. The principal dimensions are:—Length between perpendiculars, 260 ft.; breadth, 35 ft.; depth, 18 ft.; with a deadweight capacity of about 2,150 tons. She has been built under special survey to pass the highest class at Lloyd's, viz., 100 A 1. The decks are of iron, and water ballast tanks are fitted in both holds, also five water-tight iron bulkheads. She is fitted with a steam steering gear, supplied by Messrs. Bow & M'Lachlan, of Paisley; four large steam winches, by Clarke, Chapman, & Gurney, with Cochrane's patent donkey boiler; also Emmerson & Walker's patent windlass. The vessel will be fitted with a pair of George Clark's compound surface-condensing engines of 140-horse power, provided with all the latest improvements in marine engineering. She has a topgallant forecastle for the accommodation of the seamen and firemen, and cabin amidships for the officers. The ceremony of christening was performed by Mrs. Taylor, of Newcastle, wife of the inspector, who named the vessel the *Longueil.*

Maulkins Tower.—On March 18th, a steamer named the *Maulkins Tower* belonging to Messrs. Stumore, Weston & Co., of London and Liverpool, was launched from the yard of Messrs. Blumer & Co., of Sunderland. Her dimensions are:—Length, 300 ft.; breadth, 39 ft.; depth of hold, 28 ft. 3 in.; dead weight carrying capacity 4,000 tons; measurement cargo capacity 5,000 tons. She will be fitted with powerful engines by Messrs. Clarke & Co., of Elswick.

Plutos.—On March 18th a steamer named the *Plutos* was launched from the yard of Mr. T. E. Smith, at North Shields. Her dimensions are as follows:—Length, 250 ft.; breadth, 36 ft.; depth, 16 ft. The vessel is 1,700 tons burthen, and is classed A 1 at Lloyd's, and was built to the order of Messrs. Thomas Kish & Co., of Sunderland.

Castlehill.—On March 18th Messrs. Hodgson & Soulsby launched from their shipbuilding yard, Blyth, Newcastle-on-Tyne, the screw steamer *Castlehill*, to the order of Messrs. Thomlinson, Thomson, & Co., 6, Oriel-chambers, of that city, and of the following dimensions, viz.:—Length, 265 ft.; beam, 36 ft.; and depth of hold, 23 ft.; having an estimated deadweight capacity of 2,700 tons, and to class 100 A 1 at Lloyd's. Compound surface-condensing engines of 160 nominal horse power are being supplied by Messrs. Black, Hawthorn, & Co., of Gateshead-on-Tyne. On leaving the ways the steamer was named *Castlehill* by Miss A. M. Thomson, of Dumfries, sister of one of the owners.

Abergeldie.—On March 18th there was launched from the yard of the Sunderland Company (Limited), South Dock, Sunderland, an iron screw-steamer, built to the order of Messrs. Adams & Co., of Aberdeen, London, and Newcastle, under special survey, to take the highest class at Lloyd's, with extra strength, under the superintendence of Mr. Nicol, inspector to the owners. The vessel has a straight stem, and is built on the spar-deck rule, with topgallant forecastle, cellular bottom, having water ballast all fore and aft, together with all the latest improvements for rapid loading and discharging, and rigged as a three-masted schooner, having steam winches, steam steering gear by Muir and Caldwell, also double armed screw gear aft. The leading dimensions are:—Length, 320 ft.; breadth, 40 ft.; depth, moulded, 30 ft. 4 in.; the gross tonnage will be about 3,000 tons. The cabins, which are on the main deck aft, are entered through a large iron deck-house, and will be fitted up for a number of first-class passengers, the captain and officers being berthed amidships. The engines are by the North-Eastern Marine Engineering Company (Limited), of 300 nominal horse power, and include all the latest improvements for efficiency and economy. On leaving the ways she was named *Abergeldie* by Miss Adam, daughter of Mr. J. B. Adam, of Newcastle, senior partner in the firm.

Rhosina.—On March 18th, from the yard of Mr. James Laing, Sunderland, there was launched a steamer of about 4,000 tons, built for the Atlantic line of Mr. Fred. Edwards, Cardiff, and sister boat to the *Rhodora*. This vessel has been constructed in the strongest manner, beyond Lloyd's Rules, for the highest class; has three decks laid, and is specially adapted for carrying cattle. The cabins are amidships, and the crew placed forward. Her dimensions are 300 ft. by 39 ft. by 29½ ft. The engines are 300-horse power, by Mr. George Clark, the cylinders 37 in. and 71 in., and stroke 45 in., large boiler fitted with Fox's patent furnaces, and all recent improvements. The vessel has three masts with double topsail, Harfield's steam windlass, steam winches by Clark, Chapman & Gurney, the quarter-master steam steering gear, and many special arrangements in ship and engines for quick and safe working. On leaving the ways the vessel was named by Miss Laing the *Rhosina*. She has been superintended throughout by Captain Curtis, and the engines, by Mr. D. J. Morgan, of Cardiff.

Straits of Dover.—On March 18th, from the Southwick Shipyard, Sunderland, Messrs. Robert Thompson & Sons launched a steamer named the *Straits of Dover*, 3,300 tons deadweight capacity, built for Messrs. Neil, M'Lean, and partners, of Glasgow. This vessel, the register dimensions of which are 285 by 38 by 27½ ft., is spar-decked, to pass Lloyd's highest class, with a considerable excess of strength to adapt her for carrying the heaviest cargoes, and has two iron decks fore and aft, and one wood deck, which are suited for the stowage of cattle and mixed goods. The deck erections are of great strength as necessary for regular Atlantic navigation, and she is provided with the most improved arrangements and equipments for this trade. Her engines are of 250-horse power, by Mr. George Clark, the cylinders being 36 and 68 in. diameter. and 42 in. stroke. Steam reversing gear and the newest arrangements for efficient and economical working have been provided throughout the vessel. The vessel received her name from Master M'Lean.

Yeoman.—On March 18th the screw steamer *Yeoman*, built by Messrs. Campbell, Mackintosh, & Bowstead, of Scotswood Shipyard, Newcastle, for Mr. W. Lund, of London, was launched. Miss Lund christened the vessel. The *Yeoman*, which has been built for the Australian trade, is 285 ft. long; 36 ft. 6 in. wide; and 27 ft. 6 in. deep. She carries 3,250 tons deadweight, and is intended to steam 10 knots an hour. The building of the vessel was superintended by Captain James M'Kenzie, Mr. Lund's managing Captain. Messrs. T. Clark & Co., of Elswick, built the engines. The vessel has four steam winches, built by Messrs. Clark, Chapman, & Gurney, of Gateshead, and one of Messrs. Emerson & Walker's patent steam windlasses. The vessel is the third one that Messrs. Campbell, Mackintosh, & Bowstead have built, and they have at present four on the stocks.

New Resolute.—On March 20th a steamer, built for pleasure passenger traffic during summer months in the River Fal from Truro and Falmouth and back, as well as for occasionally towing purposes, was launched from the yard of Messrs. Scoble & Davies, Falmouth. The steamer is to take the place of the screw steamer *Resolute*, which has been plying on the river for the last few years. She will be 71 ft. in keel, 15 ft. beam, and 7 ft. 9 in. deep, and about 40 tons register, and calculated to carry about 240 passengers, as against 79 with the present vessel. She will be fitted up with every new appliance, and will have two powerful engines, which are to have a guaranteed speed of 11 knots an hour; supplied by Messrs. Cox & Co., of Falmouth. She was christened the *New Resolute*, by Mrs. Benny, the mother of the Captain. She is owned by Messrs. Benny & Co.

Venitienne.—On March 20th the launch of the first iron steamer ever built at Penarth, took place from the yard of the Penarth Shipbuilding and Shiprepairing Company (Limited). The steamer is a cargo boat 120 ft. in length, 20 ft. beam, and 10 ft. depth of hold, and is to be fitted with inverted compound surface condensing engines of 150 effective horse power, two steam winches, a patent windlass, water ballast tanks, and several other modern steamship appliances. She was built to the order of Messrs. Cuthbert, Hancock, & Co., Cardiff, and is intended for the French trade. The christening ceremony was performed by Miss Laura Evans, of Bath, who named the steamer *Venitienne*. She was taken in tow and berthed in Penarth Dock, where her outfit will be completed.

ON March 20th a screw steamer, built to the order of Messrs. J. Temperley & Co., of Newcastle, was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Company, Limited. The dimensions of the vessel are:—Length, 310 ft.; breadth, 37 ft.; depth, 24 ft. 9 in. She has been built under the three-decked rule, to class A 1 at Lloyd's, and has all the latest improvements, including water ballast in a cellular bottom, fore and aft, Emerson & Walker's patent steam windlass, steam winches, &c. The deadweight carrying capacity of the vessel—which is intended for the general carrying trade—will be 3,300 tons. The engines will be constructed by Palmer's Company, and will be of 250-horse power nominal, the cylinders being 36 and 68 inches respectively in diameter, and the stroke of the piston 45 in. The construction of the vessel is being superintended by Captain Marshall.

Hanoverian.—On March 21st Messrs. W. Doxford & Sons of Sunderland launched the s.s. *Hanoverian* for Messrs J. & A. Allan of Glasgow. The *Hanoverian* is of the following dimensions viz; length between perpendiculars 366 ft., breadth extreme 42 ft., depth of hold 30 ft. She is spar-decked with three iron decks and spar-decked sheathed with yellow pine, and is classed 100 A1 at Lloyds'. The engines built by W. Doxford & Sons are of 2,500 indicated horse-power with cylinders 48 and 90 and 54 stroke.

Durham City.—On March 22nd Messrs. Wm. Gray & Co. launched from their yard at West Hartlepool an Atlantic steamer for Messrs. Thomas Furness & Co.'s line, of West Hartlepool, of the following dimensions:—Length, 315 ft.; beam, 43 ft.; depth of hold, 27 ft. 6 in.; with a deadweight carrying capacity of about 4,000 tons. The engines being supplied by Messrs. Blair & Co. (Limited), of Stockton-on-Tees, are 300-horse power nominal; the cylinders, 44 in. and 83 in. diameter respectively; the length of the piston stroke 48 in. There are special arrangements, with condensers, for carrying about 650 head of cattle and a large number of sheep, which are so arranged as to admit of carrying general cargoes when space for live stock is not required, together with additional strength over and above Lloyd's highest requirements. Steam steering gear, direct-acting steam windlass, &c., are all of the latest improvements. This is the largest steamer ever built at this port, and is the sixth built by Messrs. Gray & Co., for the same owners, who hold contracts for two more. The general arrangements are much similar to the *Boston City*, which was launched last month. As she left the ways she was christened the *Durham City* by Mrs. Thomas Furness, of Foggy Furze. The *Durham City* has been built under the supervision of Captain T. King, the Company's superintendent.

Empress.—On March 22nd, Messrs. Short Brothers launched from their shipbuilding yard at Pallion, Sunderland, a steamer, built to the order of Messrs. Taylor & Sanderson, Sunderland. The ceremony of christening the vessel the *Empress* was performed by Miss L. Sanderson, daughter of one of the managing owners. She is the seventh steamer built by Messrr. Short for the same firm, and her dimensions are as follows:—Length, 290 ft.; breadth, 40 ft.; depth of hold, 20 ft.; having a deadweight carrying capacity of over 3,000 tons on a comparatively light draught. The steamer is constructed with a short full poop, long raised qnarter deck, bridge house amidships, and topgallant forecastle, ample water ballast, four large hatchways, with a powerful steam winch at each, and all the latest improvements for despatch in loading and discharging cargo. The *Empress* will be fitted by Mr. J. Dickinson, of Palmer's-hill, with engines and boilers of 180-horse power, with all the latest improvements, and will be employed in the American and Bombay trades, commanded by Captain Simpson.

Muncaster Castle.—On March 23rd, Messrs. W. H. Potter & Son launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, an iron sailing ship of the following dimmensions:—Length, 316 ft.; beam, 39 ft.; depth of hold 23 ft. 6 in.; tonnage, B.M., 2,300 tons; ditto nett register, 2,000 tons. As the vessel left the ways she was named the *Muncaster Castle* by Miss M. A. Dixon. The *Muncaster Castle* has been built to the order of the Lancaster Shipowners' Company, and is the largest sailing vessel yet built on the Mersey. She will be fitted with four masts, and has an iron main deck nearly all fore and aft, and a wood deck in addition. Accommodation for the captain, officers and crew is provided in a house fitted from side to side of the vessel amidships instead of in the poop as is customary. The *Muncaster Castle* will be steered from amidships, but in case of accident to that gear an additional steering apparatus is supplied by a turtle-backed house aft. The *Muncaster Castle* is classed 100 A 1 at Lloyd's, is fitted with all recent improvements, and is expected to be a very fast sailer. Captain W. Valentine, late of the ship *Thurland Castle*, has been selected as her commander.

Abana.—On March 24th, Messrs. M. Pearce & Co. launched from their iron shipbuilding yard at Stockton-on-Tees, an iron screw steamer, 325 ft. by 38 ft. by 26 ft. 6 in. She will be classed 100 A 1 at Lloyd's, has poop, long bridge-house, and T.G.F. double-bottom for water ballast, two iron decks, and will carry about 4,200 tons dead-weight. Her engines are 300 nominal horse-power, by Messrs. Blair & Co. (Limited). As she left the ways she was christened *Abana*.

Lamport.—On March 24th, there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, an iron screw steamer of the following dimensions:—Length, 317 ft.; breadth, 37 ft. 4 in.; depth 26 ft. 6 in.; dead-weight carrying capacity, about 3,750. The vessel has been built to the order of Messrs. Arthur Holland & Co., of London, and on leaving the ways was christened the *Lamport*, by Miss Brown. She will proceed to St. Peter's to be fitted with engines 38 in. and 70 in. by 45 in. stroke, and of 250 nominal horse power, by Messrs. R. & W. Hawthorn.

Juno.—On March 24th there was launched from Earle's Engineering and Shipbuilding Company's yard, Hull, a steamer for the Wilson Line. The ceremony of launching and christening was performed by Mrs. G, Godfrey, and the vessel was named the *Juno*. She is of the following dimensions.—Length, 256 ft.; breadth, 32 ft.; depth 16 ft. 6 in. Her gross tonnage is about 1,300 tons, and she will be propelled by engines of 200-horse power nominal. The *Juno* is intended for the Hamburg trade. The *Juno* will be provided with the latest improvements in the way of cranes and winches for the rapid loading and discharge of cargo.

LAUNCHES.—SCOTCH.

Coban.—On February 6th, Messrs. William Doxford & Sons, of Sunderland, launched the s.s. *Coban* for Messrs. Dent & Coy, of

Newcastle on Tyne. The *Coban* is of the following dimensions, viz.,—Length between perpendiculars, 230 ft.; breadth, extreme, 33 ft.; and depth of hold to top of cellular bottom, 16 ft. She is flush decked with poop, bridge and forecastle, and is classed 100 A 1 at Lloyd's. The engines built by W. Doxford & Sons are 650 indicated horse power, with cylinders 31 and 56 in. diameter, and 36 in. stroke.

Prins Frederik.—On February 22nd, Messrs. John Elder & Co. launched from their Fairfield Works, Govan, the *Prins Frederik*, an iron screw steamer, built to the order of the Stoomvart Maatshapij Nederland, of Amsterdam, and which will form an addition to their fleet of mail steamers trading between Holland and Java by the Suez Canal. Her principal dimensions are as follows:—Length between perpendiculars, 350 ft.; breadth, 39 ft.; depth moulded, 30 ft. 9 in.; gross tonnage, 3,100 tons. Ample accommodation has been provided for 60 first-class and 40 second-class passengers, besides large 'tween deck accommodation for troops.

Clan Buchanan.—On February 22nd, Messrs. A. M'Millan & Son. Dumbarton, launched from their dockyard the screw steamer, *Clan Buchanan*, of 3,000 tons register. The principal dimensions are:—Length (over all), 343 ft.; breadth (moulded), 30 ft. The *Clan Buchanan* is being fitted for the accommodation of 45 first-class passengers in a full poop 76 ft. long. The deadweight capacity of the vessel is 4,000 tons, and the speed expected is 12 knots per hour. The naming ceremony was performed by Mrs. Alexander M. Brown, of Glasgow.

Aviemore.—On March 4th, the awning-decked screw-steamer, 960 tons gross register, intended for the Baltic and Mediterranean trades, was launched from the shipbuilding-yard of Mr. W. B. Thompson, at Dundee, Miss Millar liberated the vessel from the stocks, and Miss Clara Leng performed the christening ceremony. A considerable party of ladies and gentlemen having assembled in the drawing loft, Mr. Leng proposed "Success to the *Aviemore*." He said while they all wished success to every ship launched at and sailing from the port, her owners must specially desire that the vessel just launched should be prosperous and profitable. He thought the awning deck class of vessels, protected as they were from stem to stern, much safer than the well decks, and he hoped that with them there would be fewer casualties to the officers and crews whose lives were of the greatest value to the nation. Mr. James Millar, the managing owner, in responding to the toast highly complimented Mr. W. B. Thompson, the builder, on turning out a first-rate vessel. Mr. Thompson had liberally adopted every suggestion for perfecting her equipment and accommodation, and he believed she would prove a very handy and useful craft. He was glad that although Mr. Thompson had taken a large yard on the Clyde he was not to sever his connection with Dundee, where he was now engaged in building the largest sailing ship of which the keel had been laid down on the banks of the Tay. Mr. W. B. Thompson, in acknowledging the compliments paid him, said that the difficulties shipbuilders had experienced with their workmen in Dundee had turned his attention to the Clyde, so that he might not be wholly dependent on the men here allowing him to carry out his contracts. Several other toasts followed, Mr. James Yeaman, ex-M.P., ex-Bailie Robertson, Mr. Joseph Lindsay, Convener Mitchell, and Captain Barrie taking part in the proceedings. The *Aviemore* in the meantime was placed at her berth near the 70-ton crane. She is expected to be ready for sea in about a fortnight.

Goorkha.—On March 7th, Messrs. William Denny & Brothers launched from their shipbuilding-yard at Dumbarton a steel screw steamship, of the following dimensions:—390 by 42 by 31, and of about 4,100 tons gross, for the British India Steam Navigation Company. She has been built to class 100 A 1 at Lloyd's, under special survey, and is to be fitted with a pair of compound surface-condensing direct acting inverted cylinder engines of 500-horse power nominal, by Messrs. Denny & Co., Dumbarton. She is fitted for a large number of first-class passengers. As the steamer left the ways she was named the *Goorkha* by Miss Louisa Macnaughton, daughter of Mr. P. Macnaughton, Secretary to the British India Steam Navigation Company. This vessel is a sister ship to the *India*, which Messrs. William Denny & Brothers delivered to the British India Steam Navigation Company at the end of last year.

Glanwern.—On March 7th, Messrs. William Doxford & Sons, of Sunderland, launched the s s. *Glanwern* for Messrs. John Francis, & Thomas H. Jones, of Aberystwith. The *Glanwern* is of the following dimensions, viz.:—Length between perpendiculars, 212 ft.; breadth, extreme, 30 ft.; depth of hold to top of floors, 15 ft. 6 in. She has a long raised quarter deck, with bridge and topgallant forecastle, and is classed 100 A 1 at Lloyd's. The engines, built by W. Doxford & Sons, are of 450 indicated horse power, with cylinders 25 and 48 in. diameter, and 33 in. stroke.

Ingerid.—On March 17th, Messrs. H. Murray & Co. launched from their yard at Port Glasgow a screw steamer of about 600 tons. This vessel has been built to highest class of Lloyd's and up to the requirements of the Board of Trade for passenger steamer. She will be fitted with water ballast, steam windlass winches, and all the latest improvements for rapid despatch, and have accommodation for 36 passengers. This steamer has been built to the order of James Rankine & Son, Glasgow, for Messrs. D. Burger & Son, Rotterdam, to be employed in their Rotterdam and Bergen line. She will be fitted at Dumbarton with engines of 80-horse power, by Messrs. M. Paul & Co., who are the contractors for the steamer. The vessel was named *Ingerid* by Miss Rankine, of Glasgow.

Amphitrite.—On March 20th, Messrs. Robert Duncan & Co. launched at Port Glasgow an iron sailing ship called the *Amphitrite*, of the following dimensions:—Length, 255 ft.; breadth of beam, 39 ft. 6 in.; depth of hold, 23 ft. 6 in.; about 1,700 tons register. She has been built to class 100 A 1 at Lloyd's, and 20 years in Red, Liverpool Registry. The *Amphitrite* is owned by Mr. Colin S. Caird, Greenock, and is to be engaged in the East India trade. She is a sister ship to the *Poseidon*, built by Messrs. Robert Duncan & Co. for the same owner. After the launch the *Amphitrite* was towed to Greenock, where she will load for San Francisco.

Posang.—On March 21st the London and Glasgow Shipbuilding Company launched at Govan a screw-steamer of about 1,500 tons burthen, built to Lloyd's highest class, and which will be engined by her builders with compound engines of the most modern type of 200-horse power. This vessel, which has been built to the order of Messrs. Jardine, Matheson, & Co., of London and China, was named the *Posang* by Miss C. Macnab.

Clan Graham.—On March 21st, Messrs. Napier, Shanks & Bell, Yoker, launched an iron screw steamer, of about 3,200 tons register, being the first of two sister ships building by them for Messrs. Cayzer, Irvine & Co.'s "Clan Line," and specially designed and fitted with every modern requisite for their Indian service. The vessel was named the *Clan Graham* by Miss Wotherspoon, of Paisley, and is 330 ft. long, 40 ft. beam, and 29 ft. depth moulded. She is constructed under special survey, in excess of the requirements for Lloyd's highest class, and the Board of Trade certificate. She has a double cellular bottom formed by deep longitudinal girders with transverse bracket floors, and extra web framing to sides, the whole giving very great structural strength and rigidity. The vessel has two decks of iron, the upper sheathed with wood planking, and web frames in lieu of orlop beams. The water-tight bulkheads are all carried to the upper deck, and these and all other fittings are arranged to meet the Admiralty requirements for placing the vessel on their list for the conveyance of troops. The vessel has accommodation for 50 first-class passengers. The equipment connected with the navigation and working of the ship is of the most complete description, all modern improvements having been adopted to render the vessel thoroughly efficient under every contingency. The engines, constructed by David Rowan, of Glasgow, are of the most approved design, and have been completed to meet the highest requirements. In addition to the sister ship, to be called the *Clan Sinclair*, which is now nearing completion at Yoker, Messrs. Napier, Shanks & Bell are about to lay down two large passenger steamers for the same line, each of about 4,000 tons register, with a high rate of speed.

East Anglian.—On March 21st, Messrs. John Fullerton & Co. launched from their yard at Merksworth, Paisley, an iron screw steamer named the *East Anglian*, of 400 tons, for the East Coast Steamship Company (Limited), of King's Lynn. She is intended to carry passengers and goods between the above port, Newcastle-on-Tyne, and Yarmouth, and is fitted up to accommodate a large number of saloon and steerage passengers. She will be towed to Ayr to receive her engines of 50-horse power nominal, by Messrs. J. and T. Young.

LAUNCHES.—IRISH.

Monkstown.—On March 7th, a paddle steamer named the *Monkstown* was launched from the yard of Messrs. MacIlwaine and Lewis, Belfast. She was built to the order of the Passage Railway Company, and is intended to run between Queenstown, Monkstown, Glenbrook and Cork. The *Monkstown* will be fitted up in Belfast, after which she will proceed to her station. Her length is 140 ft.; breadth, 16 ft.; depth, 8 ft.; and she will be furnished with a pair of direct-acting oscillating engines. She is sister to the steamer *Albert*, built by this firm for the same company last year.

Mandingo.—On March 18th, a screw steamship was launched from the shipbuilding yard of Messrs Harland & Wolff, Queen's Island, Belfast. The vessel, which is of very large dimensions, is named the *Mandingo*, and is intended for the South African trade. She will be rigged and fitted in Belfast.

LAUNCHES.—SWEDISH.

Mercurius.—On March 7th, there was launched from the yard of the Motala Company, at Lindholmen, near Gothenburg, a twin screw steamer of the following dimensions:—Length over all, 250 ft.; breadth, 28 ft. 6 in.; depth of tanks, 11 ft. This steamer is built of Motala Bessemer steel, for Mr. Merkulljeff, of Astrakan, Russia, and is intended for the petroleum trade, between Baku and Astrakan, across the Caspian Sea. The petroleum will be carried in three separate compartments of the hold, and in two large cylindrical tanks, which will be placed at the after end of the ship. *Mercurius* will immediately receive her engines of 100 nominal horse-power, pumps and pipe cistern.

TRIAL TRIPS.

Athenian.—On Feb. 25th the Union Steamship Company's new steamer *Athenian* made a trial trip on the Clyde, and attained a mean speed of 13½ knots. The *Athenian* is the largest vessel which has yet been placed on the Cape of Good Hope service, her dimensions being:—Length, 365 ft.; breadth, 45½ ft.; depth, 32½ ft.; gross tonnage, 3,877; and horse power about 3,700. The *Athenian* is appointed to sail from Southampton, with the Cape of Good Hope mails, on the 9th March.

Vice-Admiral Albuquerque.—On March 1st this vessel, built by Messrs. Fraser & Miller, Bombay, to the order of Messrs. Mackinson, Mackenzie, & Co., Bombay, for the West of India Portuguese Guaranteed Railway Company, Limited, for service at their new harbour works at Marmagoa, in Indo Portuguese territory, made her trial trip. Her dimensions are 68 ft. by 11 ft. 6 in. by 6 ft., built of Malabar teakwood and copper-fastened throughout. She has been fitted with compound direct-acting inverted cylinder engines, surface condensing. Diameter of cylinders, 20 in. and 10 in.; stroke, 12 in. In the presence of numerous engineers, officials, and the representative of the Company, she ran her trial trip on the measured distance, five miles out and back, in the face of heavy sea and high wind, and although the contract speed was only 8½ knots, the builders succeeded in getting 10½ knots without any difficulty. This is the first instance, we believe, of both hull and machinery having been entirely constructed in India, and it is gratifying to find private enterprise so successful. The same firm have now five more small steamers on the stocks, and we trust they may be equally successful with them as with the one above mentioned. Mr. W. Potts, A.I.N.A., marine superintendent of the B. I. S. N. Co., Bombay, was the naval architect. The engines, being of a novel arrangement, were designs by the firm, and constructed under the supervision of Mr. John Dobbee, superintendent engineer for the B. I. S. N. Co., Limited, Bombay.

Friary.—This splendid new steamer of 4,000 tons burden, and of 1,200 indicative horse-power, built by the eminent builder, James Laing, Esq., and engined by the North Eastern Marine Engineering Co. for Messrs. Jones Brothers & Co., of Newport, Mon., left the South Dock, Sunderland, on Friday afternoon, March 3rd, to make her trial trip at sea, and notwithstanding the heavy sea consequent on the gales of the previous days, the boat ran the 3½ measured miles, repeatedly giving the mean speed of 12 knots per hour. The boat was then ordered to proceed to Plymouth, where she arrived on Sunday night, on Monday took in part cargo, and sailed the same night, arriving off Newport Harbour on Tuesday afternoon, doing the run around at an average speed of 12 knots per hour.

Benhope.—On March 4th this steamer, which was launched a few weeks ago from the shipbuilding yard of Messrs. Caird & Purdie, Barrow-in-Furness, for Joseph Hoult, Esq., of Liverpool, and was brought to the Clyde to have her machinery fitted on board by Mr. Wm. Kemp, Govan, went down the river on a trial trip. After adjusting compasses at Garelochhead, it was intended to have her speed tested at the measured mile at Skelmorlie, but the weather being too boisterous for this purpose a run down channel was made to test the engines, when the power developed at full speed was found to be 1,028 indicated horse power, and the engines working most satisfactorily. The ship then returned to Gourock Bay, and left for Barrow-in-Furness in the evening.

Minard Castle.—The s.s. *Minard Castle*, which has been built by Messrs. Raylton, Dixon & Co, of Middlesbro', for the famous "Castle Line" of Messrs. T. Skinner & Co. proceeded on her trial trip on March 4th. She is almost a sister ship of the s.s. *Bothwell Castle*, which was built by them for the same firm twelve months ago, and gave such satisfaction to her owners as at once resulted in a duplicate order. The *Minard Castle* is a very handsome vessel of 332 ft. over all, 38 ft. beam, and 26 ft. depth of hold, having rather finer lines than the sister vessel, so that she may be expected to give better speed, as was proved on her trial trip. She has a gross register of 2,550 tons, and will carry 4,000 tons of tea, as well as coals, for her homeward voyage. Her decks and fittings are all of East India teak, and there is a spacious deck-house aft, which contains the cabins fitted out with great taste in white marble, with Doric columns, and oak and ebony furniture in latest artistic siyle, tinted glass, &c., &c. The engines are by Messrs. T. Richardson & Son, and will indicate 1,300-horse power, having cylinders of 40 and 75 in. diameter, and 42 in. stroke, with very large boiler power. She proceeded to sea on Saturday morning, the 25th inst., having 1,200 tons deadweight on board, and a mean draught of 15ft. 3 in., and after adjusting compasses of the Tees, made a most successful speed trial, attaining the remarkable result of 13·6 knots per hour, equal to over 15½ miles. On board were Mr. Raylton Dixon, the builder, Mr. T. Richardson, and the representative of the owners, Messrs. Thomas Skinner & Co. The vessel has been built under the superintendence of Captain Campbell, and her engines under that of Mr. Beldam, both of which gentlemen have recently obtained such credit in connection with the s.s. *Stirling Castle*, built by Messrs. John Elder & Co. for the same firm, which is one of the largest and by far the fastest-going ocean steamer afloat.

Thames.—On March 6th the new steamer built for the Peninsular and Oriental Company's passenger service between London and the East, by Messrs. James and George Thomson, Clydebank, Glasgow, went down the Firth on her trial trip. The new vessel is 390 ft. long, 42 ft. broad, and 35 ft. deep (moulded), and has a gross tonnage of 4,200. She has accommodation for 120 first, and 50 second-class passengers, and also limited steerage arrangements. The vessel is supplied with a pair of two-cylinder surface-condensing engines, guaranteed to indicate 5,000-horse power; but this indication was exceeded while on her builder's trial to the extent of 750, and with 66½ revolutions per minute a mean speed of 15·93 knots per hour was then attained. On the 6th the new vessel had a most successful experimental cruise, leaving the Holy Isle in the distance before returning up the Firth, during which 15·1 knots were registered—a performance that gave every satisfaction to both owners and builders. During the run she listed to the extent of 12 degrees, there being a strong breeze and the sea somewhat lumpy, and this, it was stated, would affect her speed to the extent of over half a knot. The new vessel is equipped with Sir William Thomson's deep sea sounding apparatus, Messrs. Muir & Caldwell's steam steering gear and winches, and every necessary for safety at sea.

Casino.—On March 9th the new s.s. *Casino*, recently launched from the shipbuilding yard of Messrs. Gourlay, Brothers & Co., Dundee, made a trial of her engines. Although the weather was rather boisterous, the vessel made three runs over the measured mile near Broughton Ferry, giving a mean average of about 10½ knots, the engines meanwhile running very smoothly, and everything proving highly satisfactory. The *Casino* returned to Camperdown Dock shortly after six o'clock p.m., when refreshments were served to a party of Mr. Nicoll's friends in the spacious saloon between decks, but the unpropitious state of the weather prevented ladies being present. The *Casino* sails from Dundee for Sydney, N.S.W., under the command of Captain A. G. Wilson.

Helen Nicoll.—On March 10th the new screw steamer *Helen Nicoll*, recently launched from Messrs. Gourlay Brothers' shipbuilding yard, Dundee, made a trial of her engines on the Tay. Having proceeded some distance out towards the bar, she was turned, and ran the measured mile several times, making an average mean speed of 12 knots. The engines worked very well. The vessel returned to Camperdown dock shortly before seven in the evening. The weather was rather stormy. The *Helen Nicoll* sails for Brisbane, Queensland, and will be employed in the coasting trade.

Scotia.—On March 13th the Transatlantic steamer *Scotia*, recently launched from the yard of Messrs. J. & H. Morton, Leith, left Leith and proceeded down the Firth on her official trial trip, which was considered highly satisfactory, a speed of 11 knots being attained. The *Scotia*, which is the property of a French firm, proceeded to Shields, where she loads a cargo for Marseilles.

Stirling Castle.—The new China clipper made her trial trip on March 18th, and proved herself to be the fastest steamer afloat. A party of gentlemen, at the invitation of Mr. Pearce, joined the vessel at the Tail of the Bank, among the number being—Mr. Thomas Skinner, Mr. J. W. Skinner, Mr. W. A. Skinner, Mr. W. Cairney, Captain Campbell, Mr. A. Beldam, superintending engineer of the London & China Line; Signori Mattei and Raggio, Genoa; Captain J. Steele, San Francisco; and Mr. W. H. Woodthorpe, Board of Trade Surveyor. The *Stirling Castle* was built for Messrs. Thomas Skinner & Co's steam-clipper line by Messrs. John Elder & Co., and was launched on January 21st last, being christened by Miss Reid. The vessel is 436 ft. in length, 50 ft. beam, 33 ft. in depth, and registers 4,300 tons gross. Her set of engines are of Messrs. Elder & Co's three cylinder type, indicating over 7,000 horse-power. The sizes of cylinders are—one of 63 in. in diameter, and two of 90 in., with 5 ft. 6 in. stroke. The total heating surface of the boilers is 21,160 sq. ft., and the grate surface 787 ft. The boilers are of Parkhead steel, with Fox's corrugated furnaces, and the propeller, which is made of manganese bronze, is 24 ft. 4 in. in diameter, with a pitch of 31. As soon as the party got on board the steamer went down the Channel, and ran the measured mile six times, both with and against wind and tide, giving an Admiralty mean average of 18·418 knots, equal to 21,303 miles. The average number of revolutions on the trial was 66½ a minute, with 100 lbs. of steam pressure to the sq. in., and 28 in. vacuum. The contract speed for the vessel was 17½ knots, and the draught of water was to be 22 ft. 3 in. mean, while in reality it was 3 in. in excess of this measurement. Notwithstanding the high speed, the vessel was remarkably steady, and the vibration was almost imperceptible. This was very markedly shown by filling a wine-glass with water as full as it would hold and placing it on the saloon table. Even in the fastest run not one drop overflowed. On the previous day there was an official six-hours' trial of the steamer, when the average speed going and returning was 18·18 knots. The visitors were afterwards entertained to luncheon on board, when Mr. Pearce presided, and Mr. Bryce-Douglas occupied the croupier's chair. "The Health of the Queen" having been drunk, the chairman proposed "Success to the *Stirling Castle.*" He said:—This ship, I have no doubt, will be watched with a great amount of interest. You are aware that she has been built to carry the first teas of the season home from China. I believe it is quite impossible, consistently with our present knowledge and resources, that a ship can be built to suit that trade to go faster and carry more than this. If you build a ship to go faster you must necessarily have a larger vessel and bigger engines, and if the engines are bigger they are necessarily heavier, and take up more room. Now, as the depth of water in the Hankow river is limited, it necessarily follows that the dimensions of your ship must be limited also, and when I, in connection with my friend Mr. Skinner, discussed what would be the best size for this ship, we came to the conclusion that a ship of these dimensions and this power was the maximum size and the maximum speed that could be profitably employed in that special trade. I am not going to say what this ship will do, but I may say that she has done what no other ocean-going ship in the world has ever done. She has in six consecutive runs, with a cargo of 3,000 tons dead-weight on board, made an average speed of about 18½ knots per hour. This vessel has not only been constructed particularly for carrying teas, but it is adapted for other purposes which may be required. She may be used as an Atlantic liner, and she is peculiarly adapted for cruising, being very strongly built, and capable of carrying the heaviest guns, besides having facilities for carrying a sufficient quantity of coal for a twenty-four days' run. She has more than the usual number of bulkheads, rendering her unsinkable, and perfectly safe in case of collision. The *Stirling Castle* complies with all the Admiralty requirements, and being on their list is supposed to be a distinction and thing to be aimed at by owners; but it happened that the last time this country had unfortunately to convey troops in time of war, our Government, for some reason or other, selected some of the oldest and slowest ships in our mercantile marine. However, it may be when we have another Government, who are more alive to the interests of the country, ships of this type may in future be chosen for purposes of such great importance. The toast was enthusiastically responded to, and Mr. Skinner, in reply, gave a brief sketch of the trade with China when the Boston clippers and American merchants had a monopoly of this branch of commerce till the present time. In conclusion, he said: How this ship may succeed no man can foretell. In conjunction with the able gentlemen associated with me in connection with this vessel—Captain Campbell and Mr. Beldam, the engineer, aided by Mr. Pearce and assisted by Mr. Bryce-Douglas—we have developed a vessel which will command the attention of the China trade. The merchants of China have so far appreciated what we have done, and I have still faith in them to recoup us for the enormous capital invested. We have still faith in their liberality, and believe they will give us such freights as will reward us for the risk we have taken. As to the vessel's adaptability for other purposes, I have not the slightest doubt that should the Admiralty ever require such services as those undertaken by Captain Semmes and the *Alabama*, she will be quite fit for them. At the same time, I hope she will be devoted to the purposes of peace. Though well suited for a cruiser, she will prove of more benefit as a merchant ship. There is no doubtt that no ship in the navy can approach her in speed at the present time, and she could simply go alongside another vessel, drop a torpedo, and run away before she could be attacked. I thank you for the manner in which you have drunk this toast, and offer my congratulations to Mr. Pearce and Mr. Bryce-Douglas, and all connected with the building of the vessel, on their success, and tender them my hearty thanks for the courteous and pleasant intercourse we have had together. The company then returned to Glasgow. The *Stirling Castle* is to be under the command of Captain Marshall, late of thd *Loudoun Castle*, and is to proceed to China direct from the Clyde for the purpose of bringing home 5,000 tons measurement of the first teas this season.

Aviemore (s).—On March 23rd this vessel, which was recently launched from Mr. W. B. Thomson's Yard, Dundee, left the jetty at Camperdown Dock for the purpose of having her engines tested. On her passage down the river she ran the measured mile at the rate of 11 knots per hour, which was considered very satisfactory.

Olinda.—The steamship *Olinda*, belonging to Messrs. James Moss & Co., of Liverpool, went out on her trial trip on March 23rd, after having been fitted with a pair of compound surface-condensing direct acting engines, having cylinders 23 in. and 46 in. diameter respectively, and a stroke of 36 in., with a large steel boiler carrying a working pressure of 100 lbs. per square in., which have been constructed and fitted on board by Messrs. David Rollo & Sons, Fulton Engine Works, Liverpool, under the superintendance of Mr. W. Esplen, consulting engineer. The trial trip was in every way a success, and at 74 revolutions per minute a speed of over 10 knots was attained. There were present on board, Mr. Shirly, one of the managing owners, Mr Cook, Mr. George Rollo, Mr. Bushby, Board of Trade, Mr. Jordan, Mr. Shearer, superintendent engineer for the Company, and several others.

Triton.—This surveying vessel, which was built for the Government by Messrs. Samuda Brothers, has had a preliminary trial of her engines and machinery on the measured mile, Maplin Sands, near Sheerness, with a very unsaisfactory result. The speed attained was 12 knots per hour, but, notwithstanding that the vessel was subjected to a severe test, it was found impossible to produce the indicated horse-power provided for in the contract, the highest horse-power registered being 120 below the requisite number. Commander Balfour and the officers of the Steam Reserve conducted the trial. The *Triton* was taken into the steam basin to have the defects in her machinery remedied. When ready for commission the *Triton* will supersede the *Porcupine* in surveying duties on the coast of Scotland. The *Triton*, 6 composite paddle steam vessel, 400 tons, 350-horse-power, has since had a further six hours' trial of her engines and machinery on the measured mile at the Maplin Sands. The vessel was in charge of Captain C. J. Balfour, of the Medway Steam Reserve, and Mr. Butler, of Whitehall, represented the Admiralty. The engines, which were manufactured by Messrs. Maudslay, Sons & Field, of Lambeth, worked very satisfactorily, the mean speed being 10·8 knots per hour; indicated horse-power, 366; revolutions per minute, 44·57; mean pressure of steam in boilers, 73 lbs. per square inch. Mr. Warriner, contractors' engineer, was in charge of the engines. A large number of the Medway Steam Reserve officials were on board, and great interest was taken in the trials in consequence of the vessel having compound paddlewheel engines.

Ajax.—The six hours' run of the *Ajax*, 4, armonr-plated turret-ship, at the measured mile off the Maplin Sands, terminated most satisfactorily. The vessel was in charge of Captain Lord Walter Kerr, of the Medway Steam Reserve; and among those on board were Mr. Oliver and Mr. Bannister, from the Admiralty; Mr. Hodd, chief inspector of the machinery of the Medway Steam Reserve; Mr. Bedbrook, chief engineer of Chatham dockyard, &c. The contractors for the engines, Messrs. Penn & Sons, were represented by Mr. John Penn. The vessel is supplied with engines of 6,000 horse power, and the power indicated at the trial was 6,440. The average speed obtained was a little over 13 knots an hour, which was slightly in excess of what was expected, and the engines worked very smoothly. The vessel will now complete her fitments at Chatham dockyard, prior to being commissioned.

TRIAL TRIPS.—SWEDISH.

Hekla.—On the 11th March, this vessel, recently completed by Kockums Mekaniska Werkstads Aktiebolag, in Malmö, for the Steam Ship Company "Thingualla," in Copenhagen, left Malmö on a trial trip in the Sound. The vessel is intended for the emigrant trade between Copenhagen and New York; the dimensions are 312 ft. length, by 39 ft. breadth, and 22 ft. depth of hold. She is spar-decked, and arranged with every convenience for 700 emigrants, besides 30 first-class passengers, and will carry 3,000 tons deadweight. The engines, built by the same firm, are of the usual compound inverted type, with cylinders of 53 in. and 92 in. diameter, and 4 ft. stroke. The pumping arrangements are unusually complete; in addition to the bilge pumps there is fitted a Kirting's ejector and a centrifugal engine, which, in connection with the donkey are, either separately or together, available for pumping from every compartment and tank in the ship. The vessel is heated by steam all over, and fresh and salt water is laid on fore and aft, with steam pumps and reservoirs in connection. Steam steering gear, steam starting gear, distilling apparatus, steam cooking pans, are also fitted. Although the weather was stormy on the day of the trial trip, the ship's performance was in every way satisfactory. During a consumption trial with mean indicated horse-power 1,593, the speed was 11·53 knots, with a consumption of two pounds f. h. p. per hour; and during a later full-speed trial, the f. h. p. was 2,425, with a speed of 13½ knots. At the close of the trial an interesting experiment was made by disconnecting the air pumps and working the condensor on the injection principle, and using the circulating pumps as an air pump. The engines were kept working at 55 revolutions, and a steady vacuum of 26 in. was easily maintained. The vessel steamed then into Copenhagen, and was handed over to the Steam Ship Company.

Kronen.—On March 18th, this vessel, from Kockums Mekaniska Werkstads Aktiebolag, in Malmö, was delivered to the "Falster Sjcellandski" Steam Ship Company in Nykjöbing, on the island of Falster, Denmark. She is intended for the cattle trade, between Denmark and Newcastle, and is built of steel, measuring 167 ft. by 25 ft. by 12 ft. 12 in. She is spar-decked all over, and arranged for carrying 250 head of horned cattle, besides pigs and sheep, and is provided with the most improved appliances for watering, feeding and penning the cattle on board ship, and for rapid and easy shipment and discharge. The engines are of the usual type—inverted compound, cylinders being 26 in. and 75 in., with 30 in. stroke, and 80 lbs. steam. The consumption trial of four hours gave a speed of the loaded vessel of 10·9 knots, with a consumption of 940 lbs. of coals per hour; indicated horse-power as mean, being 445, whereas the guaranteed speed with the same consumption was 10 knots. The vessel started on her first voyage to England on the 23rd,

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—Ed.]

To the Editor of The Marine Engineer.

Sir,—Will you or any of your readers, through the columns of your journal, favour me—1st. With a method of finding the volume of steam, under any pressure, which a given quantity of water will produce (I understand that water and steam at atmospheric pressure are as 1 to 1,700). 2nd. I want to find, from the volume of steam passing through the cylinder, the number of pounds water evaporated in the boiler for every pound of coal consumed. Will you oblige me with an example? And 3rd. Whether is the throw of an eccentric the distance from the centre of shaft to the centre of pulley, or the difference of the radii of the circles described by the outside of the pulley nearest, and the outside of the pulley furthest from the centre of shaft? I have met with people who hold to the first, and people who hold to the second opinion, the latter, too, state further that the throw of an eccentric differed from the throw of a crank in that the crank doubled its throw and the eccentric does not. I think that in speaking of either it should be the distance from centre to centre in either case, but will be very glad, if I am wrong, to be corrected.

I remain, Yours respectfully,

A. B.

Shipbuilding on the Tyne.—The iron shipbuilding trade of the Tyne is as brisk as ever. Messrs. Hepple & Co., have the trawler Monarch, of Sunderland, on their slipway. Messrs. T. & Wm. Smith, of North Shields, have three steamers in hand, and they will be launched during the spring. The barque *Tronbridge*, of Newcastle, has just been re-coppered in Messrs. Smith's Graving Dock. Four steamers are in course of construction at Messrs. A. Redhead & Co.'s yard, South Shields. One of them is for Messrs. J. Fenwick & Sons, of London, and is nearly ready for launching; the other three are for Messrs R. Harroway & Co., of Whitby. Both Messrs. Palmer & Co.'s yards at Howdon & Jarrow are full of work. which will keep the men all well employed until the spring of 1883. Messrs. Swan & Hunter and Messrs. Schlinger & Davis, at Wallsend, have each four vessels on the stocks. Several large steamers are in course of construction at Messrs. Leslie's Works at Hepburn Quay. The Tyne General Ferry Company are building a passenger boat at their yard at St. Peter's. Mr. E. Lindsay is building two small iron steamers at the Mushroom. The new shipbuilding-yard occupied by Messrs. Campbell & Co. at Scotswood is full of work.

Influence of Oil on Rough Water.—A trial to test the benefit of the use of oil in lessening the power of the sea took place at Montrose, on January 30th, in the No. 1 lifeboat *Mincing Lane* (James Watts, Coxswain), having a crew of 18 fishermen. They were supplied with four gallons of dark cod oil in one two-gallon jar and two one-gallon tin flasks. The boat was launched at 10.50, and towed across the bar by the tugboat. The wind was E.N.E., fresh to strong, with the sea breaking pretty heavily on the Annat Bank, a sandbank which extends about half a mile to the east on the north side of the river. The following is the report of the Coxswains:—"We pulled down to windward of the Annat Bank, put out our drogue, and came on slowly before the sea right along the top of the bank, where the heaviest of the sea was breaking. As we approached the bank, when we saw a sea approaching, we began pouring out the oil slowly from each quarter, and continued doing so while on the bank, using about two gallons. When we poured out the oil we thought the sea was to break heavy, and were astonished to find that by the time it came to us it had fallen to almost nothing; but we noticed the sea breaking heavy on each side of us. There were eight or ten heavy seas followed, but none of them broke upon us, and we saw them breaking on each side of us. We were getting into shoal water, and we felt the lift of the rollers. They did not rise high and did not break. There was no 'back draught' towards them, as is usual when a roller is curling to break, but they seemed to move forward quicker and lower under the oil. Second Trial.—We pulled into the river and out again to the north-east of the bank, and while on the outer end of the bank, when turning the boat to come in before the wind, and before we put out any more oil, we were struck by a heavy sea on the quarter, which broke on board and hove the lee gunwale into the water, shipping a good deal of water; put out the drogue, and came in again slowly over the bank, rather more to the north side than last time. There was a much heavier sea breaking then. Poured out the oil as formerly, using the other two gallons; and although there was more 'lift' at sea we came in the same as on the first trial. The smooth astern of the boat continued the same as the first time, and we noticed the sea breaking heavily ahead of us, and on both sides. The oil used in the first trial had been carried into the river with the flood tide before we made the second trial. We are of opinion that if we had been coming in without the oil we would have shipped several seas on board, and we think that in certain circumstances it would be very useful in heavy weather in lifeboat service, and that a supply of it should be carried in lifeboats. The sea on the harbour mouth would have been too heavy for the smaller fishing-boats entering in safety. We consider it very valuable for fishing-boats, and recommend that every boat ought to carry one or two gallons in tin flasks with them. Reported by—James Watt, Cox.; Thomas Watt, Second Cox.; Wm. Mearns, Jun., Second Cox."

The Strongest Ship in the World.—It is stated that the Admiralty are about to lay down at Portsmouth a new armour clad vessel which will be stronger than any ship in our fleet, or in any of the foreign navies. She will combine a high rate of speed with great thickness of armour-plating, and her armament is expected to consist of four of the new seventy-four ton breech-loading guns.

The following are the dimensions of the new armour-plated barbette ship *Rodney*, which has just been commenced at Chatham dockyard:—Length between perpendiculars, 325 ft.; extreme breadth, 68 ft.; depth in hold, 25 ft. 2 1·8th in. She will carry ten heavy guns, will be fitted with engines of 7,000-horse power, and will have a tonnage of 9,158 tons.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

February 25th, 1882.

Barr, Hugh D.	2 C	Lvrpool.
Boyss, Scarth	2 C	London.
Brotchie, Donald	2 C	N Shlds.
Croma, William	2 C	do.
Cunningham, S.	1 C	London.
Davies, Thos. J.	2 C	Cardiff.
Dunn, Walter	1 C	London.
Edwards, John	1 C	Cardiff.
Evans, Sidney	2 C	N Shlds.
Ford, John	2 C	do.
Golightly, Mthw.	2 C	do.
Granger, Geo.	2 C	London.
Groat, Thomas	2 C	Lvrpool.
Hallett, Wm.	2 C	N Shlds.
Harburn, Rchd.	2 C	do.
Jones, Geo. P.	2 C	Cardiff.
Kemp, William	2 C	Aberdn.
Lewis, William	2 C	Cardiff.
Maddison, Jno.	1 C	N Shlds.
McGavin, Robt.	2 C	Lvrpool.
Peel, Samuel T.	1 C	N Shlds.
Porter, James	1 C	Aberdn.
Pugh, David ...	2 C	Cardiff.
Rowe, John T.	2 C	do.
Scott, Ralph ...	2 C	N Shlds.
Spurling, Sml. J.	2 C	London.
Stather, Wm. H.	2 C	do.
Stephenson, E.	2 C	Lvrpool.
Struthers, Robt.	2 C	do.
Tweedy, W. G.	2 C	Cardiff.
Watson, Wm.	2 C	Aberdeen
Wetherell, C. S.	2 C	N Shlds.
Wilks, Saml. J.	2 C	Lvrpool.
Williamson, Jas.	1 C	Glasgow.
Young, Geo. G.	2 C	Aberdeen
Young, George	2 C	London.

March 4th, 1882.

Adams, James...	2 C	London.
Avery, George	2 C	Lvrpool.
Barnie, George	1 C	Dundee.
Buchanan, Elias	2 C	Lvrpool.
Craig, Andrew	2 C	Glasgow.
Davison, George	1 C	Sndrlnd.
Derrett, Tom	2 C	N Shlds.
Dey, Andrew ...	1 C	do.
Drummond, D.C.	2 C	Dundee.
Dunlop, Wm.	2 C	Glasgow.
Elliott, Benj. ...	1 C	Sndrlnd.
Fleming, Mthw.	2 C	Glasgow.
Gibson, James	1 C	Dundee.
Gifford, John ...	2 C	Glasgow.
Hackworth, Albt.	2 C	Sndrlnd.
Hansen, C. ...	2 C	Glasgow.
Harraghy, John	2 C	Lvrpool.
Henry, William	1 C	Glasgow.
Hope, Tom ...	1 C	Lvrpool.
Hutchison, A.	2 C	Dundee.
Jones, George	2 C	Bristol.
Kerr, Robert ...	2 C	London.
Lumgair, Wm.	1 C	Dundee.
Mackrall, James	1 C	N Shlds.
Mills, James ...	1 C	Sndrlnd.
Percival, Thos.	1 C	London.
Prew, A. H. J.	2 C	Bristol.
Rogers, Geo. J.	2 C	London.
Russell, James	1 C	Glasgow.
Shores, Wm. W.	1 C	Hull.
Slater, Andrew	2 C	London.
Stamford, Jas. A.	1 C	Lvrpool.
Stewart, James	2 C	N Shlds.
Syme, Samuel	2 C	London.
Tasker, Andw.	2 C	Dundee.
Tiltman, Jno. H.	2 C	Lvrpool.
Tomlin, Thos. J.	1 C	Sndrlnd.
Wright, Thos.	1 C	do.

March 11th, 1882.

Beilby, John A.	1 C	Hull.
Brunswick, Rbt.	2 C	N Shlds.
Campbell, Mthw.	2 C	Belfast.
Cowan, James	2 C	do.
Craig, John ...	2 C	do.
Davy, Samuel V.	1 C	Hull.
Elder, Robert ...	2 C	Leith.
Elwood, R. H.	2 C	London.
Fairweather, J.G.	1 C	Leith.
Hogg, Robert	2 C	N Shlds.
Hutchinson, J.W.	2 C	Leith.
Kitching, Henry	1 C	Hull.
Lamont, Peter	2 C	Lvrpool.
Langbottom, F.T.	1 C	do.
Lawson, Wm.	1 C	N Shlds.
McKenzie, J. G.	1 C	London.
McMaster, Thos.	2 C	Lvrpool.
Mossman, T. S.	2 C	do.
Old, Richard ...	2 C	N Shlds.
Phelps, Rees ...	2 C	London.
Preacher, John	2 C	Lvrpool.
Riby, James ...	2 C	Hull.
Saint, William	2 C	Sndrlnd.
Sells, John H.	2 C	London.
Syme, John ...	2 C	Leith.
Wass, John W.	2 C	N Shlds.
Weir, John ...	1 C	Lvrpool.
Whitson, Alex.	2 C	Leith.
Williams, H. R.	2 C	N Shlds.

March 18th, 1882.

Anderson, H. J.	2 C	London.
Baker, George	2 C	do.
Jones, Owen ...	1 C	Lvrpool.
Millar, George	2 C	London.
Orme, John A.	1 C	Lvrpool.
Russell, Wm.	2 C	do.
Targett, Alfd. S.	2 C	London.
Vincent, R. J.	2 C	do.
Wardlaw, Geo. E.	2 C	Lvrpool.

March 25th, 1882.

Aird, John W.	2 C	N Shlds.
Anderson, James	1 C	Dundee.
Anderson, Wm.	2 C	N Shlds.
Bruce, Alex. M.	2 C	Aberdeen
Burdon, John ...	1 C	N Shlds.
Cameron, David	2 C	London.
Canty, Thomas	2 C	Cardiff.
Cole, Richard	1 C	N Shlds.
Davenport, Hny.	1 C	Cardiff.
Dow, Peter ...	1 C	Lvrpool.
Duncan, Andw.	2 C	N Shlds.
Ferguson, R. R.	1 C	do.
Fleming, Arth.	2 C	Cardiff.
Fox, Eugene C.	1 C	N Shlds.
Gordon, James	2 C	Aberdn.
Gough, William	2 C	Lvrpool.
Hardcastle, Geo.	2 C	N Shlds.
Holmes, Fdk. W.	2 C	London.
Hunter, James	2 C	Cardiff.
Letton, T. F. R.	2 C	London.
Le Quesne D. ...	2 C	Cardiff.
Milne, William	2 C	London.
Pearson, Robert	2 C	Cardiff.
Petersen, Carl E.	2 C	N Shlds.
Randall, Jno. W.	2 C	London.
Redford, Benj.	2 C	N Shlds.
Scott, Andrew	1 C	Lvrpool.
Scott, Edwd. T.	1 C	Dundee.
Stewart, James	1 C	N Shlds.
Thomas, Philip	2 C	Cardiff.
Thompson, Fred.	1 C	Hull.
Yorke, Chrstphr.	2 C	Cardiff.

ROBERT JACKSON, Registrar-General.
General Register and Record Office of Shipping and Seamen,
32, Basinghall Street, London, E.C.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 21st February, 1882, to 24th March, 1882.

832 J. B. Root (communicated to W. R. Lake). Propelling vessels.
843 J. A. Wilkinson and N. McGonnell. Detaching ship's boats.
859 T. Lambert. Screw propellers.
871 T. Davison. Ship's speed indicator.
878 T. Heppell. Screw propellers.
883 J. Nisbet. Motive power engines.
929 L. Boye. Hygrometer.
933 J. J. Wilson. Compass correctors.
944 P. Louze (communicated to H. J. Haddan). Piston rod packings.
964 J. P. Robinson (communicated to T. F. Walker. Steering apparatus.
987 W. Wilkins. Life preservers.
992 J. Cooke. Propelling and steering.
1004 W. Webster (communicated to F. Webster). Ships' logs.
1007 V. H. Hallock (communicated to S. P. Wilding). Damper regulator.
1009 A. P. Bliven (communicated to H. H. Lake). Construction of ships.
1022 W. Blythe. Grain elevator.
1032 J. A. Andrée (communicated to C. D. Abel). Swimming aid.
1051 J. D. Ellis. Armour plates.
1053 M. E. T. Bülow. Supporting and disengaging boats.
1056 J. P. Wright. Collapsible or folding boats.
1072 T. Nordenfeldt. Naval and field ordnance carriages.
1073 J. E. Mouland. Steam vessels propelled by self-contained power.
1074 J. Ripley and T. Scholes. Boiler-water feed.
1081 A. Whittal. Water velocipedes.
1083 J. Pintsch (communicated to J. Imray). Floating lights.
1086 A. Mellor. Furnaces.
1096 W. L. Williams. Hydraulic capstans, &c.
1106 E. H. Farrar (communicated to W. R. Lake). Preventing shifting of grain, or loose cargo.
1112 J. Shields. Protection of harbours and shipping.
1115 F. Pool. Utilization of tides and currents.
1124 J. Holt. Prevention of "racing."
1125 F. Lebacq. System of suspension for beds, &c., to prevent sea sickness.
1129 W. Pepper. Application of power to steering and hauling.
1145 J. I. Caso (communicated to S. P. Wilding). Motive apparatus.
1170 W. M. Bullivant. Floating anchors for use in gales, &c.
1187 Wright Jones. Slide valves.
1202 W. H. Harris (communicated to H. J. Haddan). Steam boilers.
1204 P. Malherbe (communicated to H. J. Haddan). Saving persons and goods at sea.
1205 C. W. Wardle. Steam boiler water feed.
1226 W. T. Lithgow. Propelling vessels.
1229 T. Hyatt (commnnicated to A. W. Lake). Navigation of fluids, and raising and preventing the sinking of vessels.
1244 J. Hopwood. Expansion valves.
1268 M. H. Watts and E. Swindells. Steam boiler furnaces.
1341 J. Wills. Thrust bearings for propeller and shafts.

THE *Satellite*, 8, composite sloop, 1,420 tons, 950-horse power, Navigating Lieutenant Roberts in charge, is rapidly approaching completion at Sheerness yard, and will be ready for hoisting the pennant for the first time within the next two months. Her preliminary trial of her engines and machinery (which have been fitted by Messrs. Humphrey, Tennant & Co., at a cost of £30,000) was of a satisfactory nature.

A FURTHER extension of time has been granted for the completion at Sheerness of the composite sloop *Satellite*, 8, 1,420 tons, 950-horse power, Navigating Lieutenant Roberts in charge, on account of the delay in the engineering work, which is due to some important alterations having been made in the machinery. The engines of the *Satellite* are being fitted by Messrs. Humphrey, Tennant, & Co., at a cost of £30,000.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

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All Advertisements and Business communications must be addressed to the PUBLISHER, 3, Amen Corner, Paternoster Row, London, E.C., to whom all complaints respecting irregularities in delivery should be addressed. Advertisements must be sent in not later than the 25th of each month to ensure insertion in the following number.

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All Accounts are to be remitted to the Office, 3, Amen Corner, Paternoster Row, London, E.C.

SUBSCRIPTIONS.

The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, MAY 1, 1882.

EDITORIAL NOTES.

THERE is still a very grave doubt expressed in weighty quarters as to the efficiency of the present much vaunted system of water-tight compartments for securing the safety of vessels after collision or other fracture of the hull. The late losses of the *Douro* and *Yrurac Bat* have been severe examples of the utter uselessness of the water-tight bulk heads in those instances, at least. We fear that in any of the liners or large steamers, the sizes of the mid-ship compartments are so large that they would, when flooded, suffice to sink the vessel beyond the side-lights or port-holes, some of which are sure to be open. As the bulk heads do not usually extend above the main deck, the water can rise above them and fill the other compartments by the hatch or companion ways, of which some are also sure to be open. In no case, to our knowledge, has a vessel received serious injury to her mid-ship compartments in deep water and lived through it. Again, the bulk heads are by no means of sufficient strength to stand any very great water pressure, when to that is added the shock of waves. There seems little doubt that both the *Teuton* and the *Yrurac Bat* sank from this cause, whilst the *Douro* foundered from the size of the compartment that was filled with water.

To the great necessity that still exists amongst the greater number of our passenger liners and other fine steamers, for sufficient pumping power to be available in case of leak, we have already often directed attention. Though this is tardily being provided for in some of the newest liners, the frequent disasters caused by the inability of the pumps to deal with what should only be considered insignificant leaks, are strong confirmation of our statements on this point. The conditions from an engineering point of view are very simple. A very large quantity of water, in such cases, is to be dealt with and delivered to a small height, not more than 20 feet. The supply of steam may be considered practically unlimited on board our large steamers, where the greater part of the boiler power might be diverted for the purpose in case of emergency. Centrifugal pumps, or the Pulsometer pump, have special capabilities for such purposes, as they have little tendency to foul, and their speed of delivery can be increased almost indefinitely with excess of steam supply. The pumps for circulating the condensing water should always be convertible to clearing a leak when occasion required. The ordinary reciprocating bilge pumps or condenser pumps, particularly when driven from the main engines, are quite unsuitable for any emergency, as their speed cannot be increased to any great extent at will.

A very great increase in the destructive effect of collisions now so apparent may no doubt be attributed to the perpendicular and straight stems, adopted now almost universally in large steamers. We cannot conceive that there is any sufficiently corresponding advantage attaching to this form of bluff bows as a compensation to this real drawback. That it is beautiful we do not suppose anybody is of opinion, and the increased offensive power suitable to men-of-war is surely out of place in a merchant vessel. The graduation, and consequently, comparatively indestructive effect of a collision from a vessel with an over-hanging cut-water is obvious. The cut-water would be gradually crushed by the shock, and the chief resistance offered by the vessel run into, would be in the upper works and not below water line. We do not see why the addition of a false cut-water would not be as wise a protective measure as many that are not enforced by the Board of Trade. In the case of a sudden collision and immediate danger of foundering, we think that there would be no better possible protection against loss of life by hurry and confusion, than for every passenger to know as well as the crew the boats to which they are apportioned. It is, indeed, suggested by the Board of Trade that this should be carried out by means of a preliminary drill, but we can easily understand that such a formidable matter as affecting the whole passengers is seldom, if ever, put in practice. We would suggest that it might be very simply done by the issue of numbered tickets going with the state-rooms, allotting the occupants to correspondingly numbered boats. We might assist the nervous heads of families, and others, to ascertain the position of their respective boats, or distinctive and conspicuous colours might be used for the purpose. Such an arrangement would, we feel sure, greatly mitigate the confusion always ensuing upon a sudden accident to a passenger vessel.

No sooner is the Naval and Submarine Engineering Exhibition over at the Agricultural Hall than the Shipwrights' Exhibition follows at the same place. It is mainly set on foot by the Shipwrights' and Fishmongers' Companies, and will be inaugurated on the 2nd of May by the Duke of Edinburgh. The Governments of the United States, Japan, and Holland will contribute exhibits of models, and the Norwegian Government sends a model, five feet long, of the famous *Viking* ship, supposed to be 2,000 years old and lately disinterred at Christiana. Amongst the men-of-war are comprised, as classes, sea-going ironclads to carry heavy guns and act as rams, ironclads for coast or harbour defence, steel or iron corvettes of great speed, and torpedo boats to run 18 to 25 miles an hour. Three medals, gold, silver, and bronze, are to be given in each class. In mercantile steamers medals or prizes are offered in the different classes, and also for yachts and sailing vessels. Mr. Ex-Sheriff Burt offers a prize of £50 for the best system for improved ventilation of passenger vessels.

In the matter of ventilation for vessels we see that a new system has been introduced by a Mr. D. C. Green, of New York. It consists in using a steam-driven air-pump which forces a jet of air through a special nozzle, surrounded by apertures, by which a large induced current of air is forced into the holds or cabins of a vessel. At the same time a suitable egress for the vitiated air is provided, and the flow artificially increased by a similar air-nozzle. The ejector tube is connected by branches to various parts of the compartment, so that the air may be drawn away uniformly.

The Meteorological Council are asking the captains of all liners and other vessels sailing the Atlantic to keep constant logs of the weather they encounter, making two notes in the day. They hope by this means to collect so much valuable evidence, as to the changes and variations of the wind and weather, as will enable them to make daily weather charts of the Atlantic Ocean. "The Council consider that any systematic information which can be obtained as to the origin, development, and laws of motion of the atmospheric disturbances which occur over the Atlantic Ocean, would promote the science of meteorology, and be of immediate practical utility." No doubt, such a series of systematic observations and charts would eventually lead to more perfect forecasts of weather from across the Atlantic, which is the most usual path of all our heavy weather.

RECENT PROGRESS IN MARINE ENGINEERING.

In our April, May, and June numbers 1880, we gave articles on simple and compound engines, in which we enumerated the various points of difference between them, bearing upon their economy and working, explaining in detail that the principal cause of the compound engine being so much more economical than the simple was solely that in the former the effect of employing two cylinders, in which to carry out the expansion, was to have the range of the temperature of the steam due to its varying pressure divided between them, and as the condensation and re-evaporation of the steam in the cylinder itself increases very rapidly with the extremes of temperature, to which the metal of the cylinder is subjected, the effect of so dividing the range is to largely lessen the total of the condensation. We stated that in some other respects the compound system had drawbacks to which the simple was not subject, but that on the whole the advantage mentioned above so largely outweighed them as to cause the compound to be more economical than the simple engine when applied to marine purposes.

At the conclusion of the articles we remarked that although we could not foresee the future of the marine engine, yet we did not doubt that further progress would be made, surely if slowly, and although the coal consumption had been reduced to so great an extent that, in short voyages made at comparatively low speeds, the coal account bore only a small proportion to the total expenses, yet a further increase of economy would be of the greatest importance in fast steamers making long voyages, and would no doubt open up new trades and revolutionize old ones as regards the speed of the vessels engaged in them.

Our prognostications appear now to be in a fair way of being realized. At the recent meeting of the Institution of Naval Architects Mr. Kirk, one of the partners of the firm of R. Napier & Sons, read a paper on the Triple Expansion Engines of the s.s. *Aberdeen*, a steamer lately built and engined by his firm for Messrs George Thompson & Co., who have employed up to the present a sailing fleet of upwards of twenty large vessels, almost exclusively in the Australian and China trades. The engines of the *Aberdeen* are constructed to work at a pressure of 125 lbs. per square in., and are, we believe, the largest engines yet afloat working at such a high pressure, and it is solely due to the great economy of fuel consumption expected from them that the vessel has been constructed for this trade, which is one involving long continued steaming without coaling, and one therefore in which the total amount of coal carried becomes a most serious part of the vessel's burthen. In the paper alluded to, and in a following paper read by Mr. Parker, of Lloyd's, the opinion was expressed that the employment of such high steam pressures, and consequent high rates of expansion, was only likely to be successful by employing triple expansive engines; the views of both these gentlemen being precisely those expressed in our previous articles, viz., that excessive condensation in the cylinder itself can only be prevented by lessening the variations of temperature to which it is subjected; and they think that even with a pressure of 100 lbs. per square in. the range is too great when divided between two cylinders to realize the economy which ought to be obtained by working with this pressure. In short they advocate compounding the present compound engine, if higher pressures than 100 lbs. per square in. are to be used.

In the discussion on the papers, Mr. Longridge, a gentleman who has laboured extensively in investigating practically the economy arising from expansion both with simple and compound engines, and whose opinion therefore should carry with it a deal of weight, dissented altogether from these views, and stated that his experience led him to the conclusion that with every engine working with any given pressure there was a most economical ratio of expansion depending upon the boiler pressure; but that the ratio was widely different with the same pressure according as the engine was simple or compound, and according to the ratio of the volumes of the cylinders themselves in the compound engine—the remarkable result however being obtained that the economy of both simple and compound engine is the same when each is worked at its most economical rate of expansion.

It was, however, pointed out by other speakers that the thousands of marine engines at present running in merchant steamers are experimental facts pointing in the other direction. The keen competition between rival engine builders and between shipowners who have to pay for the coal consumed, must have resulted in the survival of the fittest, and the total replacement of the simple engine by the compound for marine purposes conclusively proves that its economical advantages were greater than those of its predecessor, and the next few months will probably show whether or not, in its new form of triple expansion with higher pressures, the compound engine will prove itself a still greater advance upon the old practice.

The fact that condensation must take place in the cylinders themselves is easily inferred from Mr. Longridge's experiments; for if no such condensation took place, we should have the economy increase with every increase of expansion up to such a rate that the forward pressure would be just equal to the back pressure; whereas, the fact is, that, after a moderate rate of expansion in single cylinders has been reached, a further expansion gives a real loss of power—a result which can only be caused by the greater expansion being accompanied by a still greater amount of cylinder condensation. About this there can be no question, the only point on which a difference of opinion can arise being the actual amount of condensation taking place with every ratio of expansion.

To determine this accurately is a very difficult matter. Unfortunately, the indicator diagram, useful as it is in informing us of what takes place inside the cylinder, only gives us a knowledge of the amount of *steam* in the cylinder and not of the water or condensed steam passing through it at each stroke. Thus 20 or 30 per cent. of the steam formed in the boiler may be condensed on entering the cylinder, and not be again evaporated until the end of the stroke, without the diagram informing us of what is going on. The only way to accurately determine this is to carefully measure the feed water used in a given time, and from this determine the exact amount used every stroke. This, as our practical readers can easily conceive, is next to impossible to execute with powerful marine engines; but even this method requires to be conducted with great precision if accurate results are to be obtained.

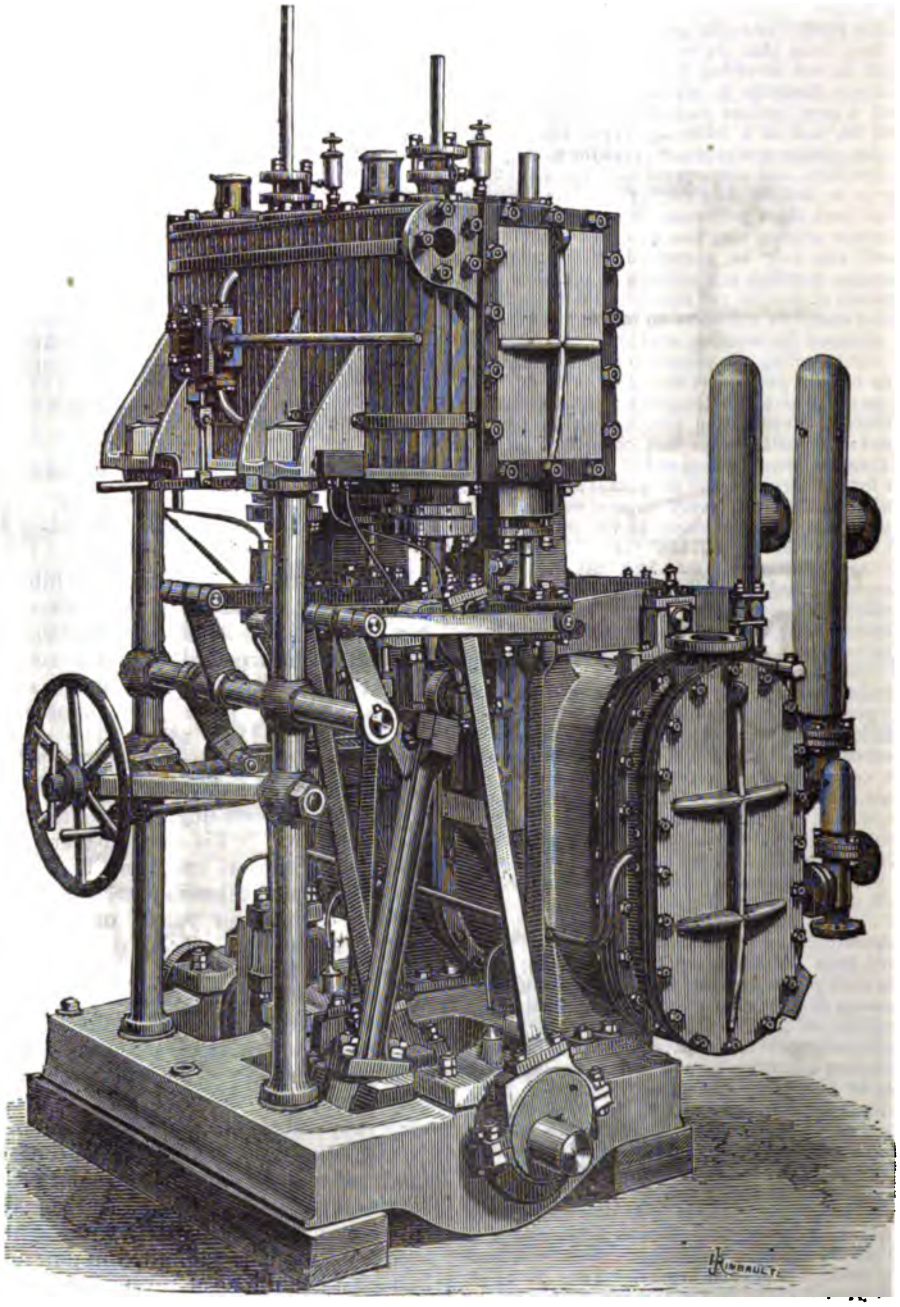
A point which is often lost sight of in engine trials, otherwise carefully conducted, is that the feed pumps are invariably constructed capable of discharging into the boiler an amount of water largely in excess of that actually required for full power, and therefore still more than the amount required for a low power; as a consequence, the pump is only partially filled with water at each stroke, the remainder of the barrel being filled with air which is forced into the boiler along with the water. The compression of this air up to the boiler pressure by the feed pump not only absorbs somewhat more power than it again gives out by expanding when mixed with the steam (and thus lessens the effective power of the engine), but the presence of this air in the cylinder, into which it must pass, is often ignored in measuring the volume of steam occupied, and the steam is therefore credited with being drier, and its condensation less than its actual condition warrants. We pointed out, in our articles referred to, the effect of the presence of air in steam in preventing or retarding cylinder condensation, and we believe that possibly some of the anomalous results stated to have been obtained by working steam with high rates of expansion in single cylinders are due to the large amount of air thus introduced and not noticed—an amount which is probably much in excess of what would be found in ordinary practice with an engine made to work at the same expansion when at full power.

As some cylinder condensation must take place, and as most experiments show that a very large condensation does take place, any step which will lessen its amount must be a step in the right direction (it was on this account that Watt's invention of a separate condenser was such a great practical success), and we look forward with confidence to the results which will be obtained by the triple expansive engines, which, we understand, are now being fitted in several other steamers.

NAVAL AND SUBMARINE EXHIBITION.

THE Naval and Submarine Exhibition which opened on Easter Monday, the 10th ult., at the Agricultural Hall, and closed on Wednesday the 20th ult., proved, as anticipated in our previous issues, a great success. This success is of such a decided nature that it has been settled to have another Exhibition on a larger scale, in May, 1884. The greatest credit is due to Mr. Samson Barnett Jun., for the manner in which, single handed, he devised and carried out this colossal and novel undertaking, having from the moment the idea originated in his brain, never ceased or flagged in his supervision over every detail worked out by his staff. The whole of the Exhibitors and interested visitors are unanimous in their praise of Mr. Barnett's valuable exertions, and many congratulations were to be heard on all sides when it became apparent that every possible success attended his efforts. The co-operation and courtesy of the exhibitors and staff was simply perfect, and everything worked smoothly between them. The order and rapidity with which all arrangements were completed, and the multitude of articles arranged in their appointed places, was marvellous, and reflected great credit on the attention and exertions of Mr. Dalton, the head of the Naval Department of the staff, and Mr. Davies, diver, the head of the Submarine Department. A feeling of regret has been expressed on all hands that such a display was so limited in duration. Never before had such a number of inventions and machines applicable to marine engineering operations been got together, and no Exhibition was ever better attended. The general wish of exhibitors and visitors that the next Exhibition may remain open for a much longer period will most likely be satisfied, and to place more space at their disposal it is very probable that the next Exhibition will be held at the South Kensington Museum.

It is an undoubted fact that exhibitions of this kind are most useful in their nature. This was fully demonstrated by the careful manner in which shipowners, shipbuilders, Admirals, Captains, Marine Engineers and many others closely connected with marine work, studied and noted all the different inventions and improvements. Not only was this done by British subjects but by large

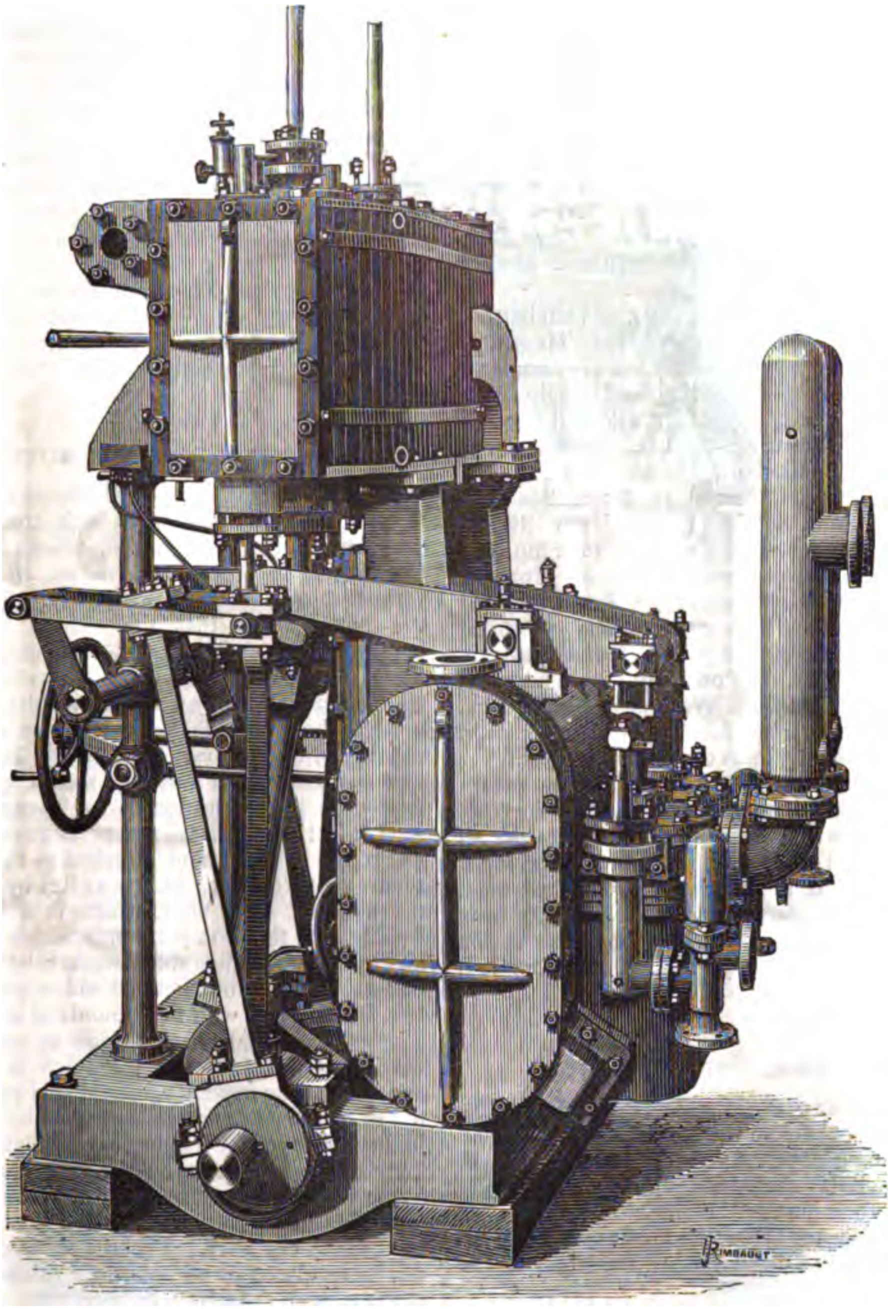


SMALL COMPOUND SURFACE CONDENSING MARINE ENGINES, by Messrs. BURRELL & SONS.
(*For Description see page* 50.)

numbers of Foreign Naval Attachés. Russian, French, Spanish, German, Italian, Chinese and Japanese representatives visited the Exhibition every day, and carefully noted in the fullest detail everything likely to be useful to the requirements of their different navies. It is quite certain that as soon as the importance of many of the improvements and inventions here shown are laid before the Superintendents of Marine Engineering of nearly all the countries in the world, a large amount of Foreign orders will come to the British market, and a fresh impulse be given to all branches of marine engineering manufactures.

The exhibits were so numerous and varied that it is impossible to classify or deal with them all. We must, therefore, confine our attention to a general description of the leading features of this Exhibition, commencing with Models of Ships of War.

In this class the Admiralty, Sir W. Armstrong, Messrs. Samuda, and Messrs. Palmer & Co., exhibit models lent for this occasion. The Admiralty exhibit models of



SMALL COMPOUND SURFACE CONDENSING MARINE ENGINES, by Messrs. BURRELL & SONS
(For Description see page 50.)

the *Devastation*, the *Monarch*, and the *Polyphemus*. The *Devastation* is a mastless sea-going turret ship carrying four 35-ton guns, with armour plating on her sides, and turrets from 10 inches to 14 inches in thickness. This model gives a fair idea of the present type of a powerful man-of-war. The *Monarch* is a masted turret vessel carrying four 25-ton guns and two 6½ ton guns, her armour plating is from 8 inches to 10 inches in thickness. The *Polyphemus* is represented by a model showing the appearance this vessel will present when finished.

Sir W. Armstrong & Co., exhibit models of the *Alpha*, *Beta*, *Gama*, *Delta*, &c., gunboats built for the Chinese Government, each carrying one heavy gun of either 35 or 38 tons of great piercing power; these guns are brought into the required line of fire by manœuvring the vessel. These gunboats carry coal sufficient for a voyage of 2,000 miles.

Messrs. Samuda Bros. show a model of the *Neptune*, designed and built as the *Independencia* for the Brazilian Government. She has four 38-ton guns in her turrets, and two 12-ton guns on her forecastle. This vessel was purchased by our Government. Her armour is from

9 inches to 13 inches in thickness. The *Belleisle* which, was originally built for the Turkish Government as the *Peiki Tl'eref*, is a man-of-war, with an octagon citadel, having a 25-ton gun at each of the four sides firing at 45 degrees angle with her keel line, and carrying 12 inches, 10 inches, 8 inches and 5 inches armour; she is a good type of a man-of-war.

Messrs. Palmer & Co. show models of gunboats built expressly for river service, armed with 64 pounders forward and astern. They are designed to draw very little water. The *Tay*, *Spey*, *Sabrina*, *Tees*, *Don*, *Dee*, *Slaney*, *Esk*, *Tweed*, *Trent*, *Medway* and *Medina* have all been built for this purpose.

Messrs. Archibald McMillan & Son, of Dumbarton, Messrs. Wm. Denny Bros., of Dumbarton, Messrs. J. Elder & Sons, of Glasgow, Messrs. J. & G. Thomson, of Glasgow, the Barrow Shipbuilding and Engineering Co., Limited, Lloyd's Registry of British and Foreign Shipping, Oswald, Mordaunt & Co., Southampton, Messrs. Short Bros., Sunderland, Donald Currie & Co., I. Laing, Sunderland, the Orient Steam Navigation Co., J. L. Thompson & Sons, Sunderland, the United Steam Ship Co., of Copenhagen, The Union Steam Ship Co., of New Zealand, J. Patten, Jun., & Co., the Monarch Line, Ismay Imrie & Co., the White Star Line, the Inman Steam Ship Co., and many others exhibited exquisitely finished models of celebrated ships. S. Bishop, J. Forrester, H. J. Pope, Andrew Thomson, the Marquis of Ailsa, Messrs. Watkins & Co., Messrs. Hatcher, Clifford & Co., and A. Payne & Sons, exhibit some very fine models of yachts of all descriptions.

The large tank erected for Mr. Barnett in the centre of the hall for the operations of the divers, and the trials of the different life-saving apparatus, was a centre of attraction throughout the whole of the Exhibition. Owing to the fact that the water supplied to this tank by the New River Co. was far from clear, very little could be seen of these operations at any time in the day but only in the morning, just after the water had been let in.

MESSRS. SIEBE, GORMAN & CO.,

inventors and patentees of the improved diving apparatus, and submarine engineers to the Royal Navy, exhibited some very interesting apparatus at their stand; and at different hours each day their trained divers appeared in the large tank in their improved diving dresses.

The late Mr. Augustus Siebe, the father of the present member of the firm, has been termed the father of the diving apparatus.

As far back as the year 1829, M. A. Siebe and Mr. A. Deane introduced the dress now known as the open dress. This was used till 1837, when Mr. Siebe invented the closed helmet, which allows the diver to work in any position required. This helmet was attached to the dress perfectly watertight by means of flanges tightened with screws and wing nuts, an inlet valve allowing the air to return, thereby preventing the diver being injured in case of any damage happening to the air-pump; the helmet and dress contains sufficient air for the diver to respire ten minutes without a supply, thus giving him sufficient time to ascend. An outlet valve permits the foul air to escape, and is so arranged that it closes on the least cessation of the supply current of fresh air, and prevents any water entering. The screw face-glass allows the diver to give orders or take refreshments with only his head above water. During the removal of the wreck of the *Royal George*, in 1840, Mr. Siebe invented the segmental neck-screw, by means of which the head of the helmet is removed from the shoulder-piece in a few seconds. Mr. Siebe has also made great improvements in the pistons, valves, and air passages of the diving machine air-pump, and by surrounding the cylinders with a cistern continually filled with cold water prevents heating from the friction of the pistons, and supplies the diver with fresh, untainted, and unexpanded air. This firm claims to have gradually improved every detail of their air-pump, helmet, dress and air-pipes, so as to admit of a diver going with perfect safety to any depth his power of resistance to pressure will allow.

MESSRS. FLEUSS, DUFF & Co.,

exhibited a Patent Combined Diving and Noxious Gas Apparatus, which dispenses with the use of helmets (in shallow water), air-pumps, tubes, &c., and allows the wearer to enter fires, mines, wells, &c., charged with foul air, with perfect safety. The principle of the apparatus is that the wearer breathes his own breath over and over again, the carbonic acid being absorbed from it at each expiration, and the requisite amount of oxygen restored, the revivified breath is fit to be again inhaled in the form of pure air. The apparatus, which is carried upon the back of the diver or explorer, consists of a strong sheet-copper cylinder, 12 in. by 6½ in., with domed ends capable of holding 4 cubic feet of oxygen gas at a pressure of 16 atmospheres. Above the cylinder, and attached to the side of it, is a square metal box, 12 in. by 12 in. by 4 in., to contain the carbonic acid filter, which is a box of vulcanite, divided into four compartments, with a wooden lid made air-tight by an india-rubber washer, having an inlet and outlet tube; this box is filled with a packing of ordinary tow, interspersed with two pounds of stick caustic soda. The exhaled breath passes twice up and down through the interstices of the tow, by which it is finely divided and thoroughly freed of carbonic acid by the caustic soda, the excess of moisture collecting under a perforated false bottom arranged for the purpose. A flat bag of vulcanized india-rubber is fastened to the apparatus and connected by an india-rubber pipe over the shoulder to the outlet pipe of the filter; the bag is also in communication with the oxygen chamber. The supply of oxygen to the bag can be regulated by a jamb screw valve under the control of the wearer. An india-rubber mask is made to fit air-tight to the face, and is held in place by straps buckled up at the back of the head. The mask is fitted with a pair of flexible valved pipes, the one for exhaling being in communication with the inlet pipe of the filter, and the one for inhaling in communication with the air bag. The exhaled breath having passed through the filter enters the bag in a purified state, and there meeting with its complement of oxygen is fit to be again inhaled.

ENGELBERT & CO.

had a good display of their well-known lubricating oil and to practical engineers it will be of interest to know that they are getting it into a large and extensive use.

Its latest application is to the Cold Dry Air Refrigerators, where it is necessary to have a good lubricant at as low a temperature as 80 below zero Fah., and as high as 300 degrees. Messrs. J. & E. Hall, Haslam & Bell Coleman, who exhibited their respective machines in action during the exhibition, all used this oil, so we had abundant opportunity of testing its qualities in actual work.

Its total absence from smell in these machines is of paramount importance, otherwise the air, which is brought into contact with it, prior to being circulated through the meat or other chambers would give an unpleasant flavour to the provisions stored therein (vide our last December number).

The oil is non-evaporative at 600 degrees Fah., and is a good lubricant at over 500 degrees.

One of its chief uses is to prevent scale in marine boilers and pitting of the plates, this has been repeatedly proved in practice, when used in engines with surface condensation.

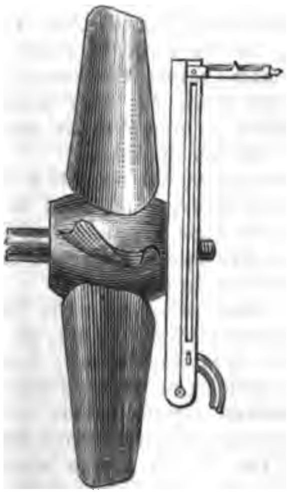
The Edwards Atlantic Line of Steamers have used this lubricant for some length of time and derived great benefits from its use, there being no dirt or deposit in the cylinders, condensers, or boilers—nor any smell in the engine room, which in some passenger steamers is most unbearable.

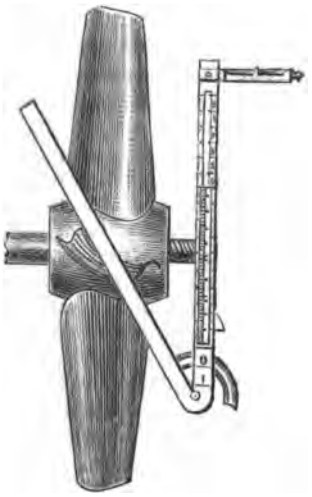
The Spanish Government are also large users of this oil.

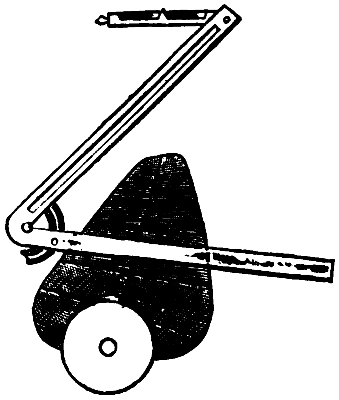
Some of its characteristic properties are perfect freedom from acid, so a positive protection from corrosion, it contains no suspended matter or grit, is a non-absorbent of oxygen, does not saponify and will not burn; in fact in our opinion it forms one of the best known lubricants.

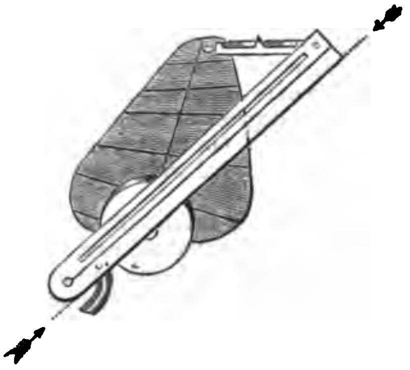
HUTTON'S PATENT PITCHOMETER,

a scientifically correct instrument for taking the pitch of propeller blades. At the Naval and Submarine Engineering Exhibition, a very useful instrument was shown at Stall 267, viz., The Pitchometer, an instrument for measuring the pitch of propellers, invented by Mr. Hutton, a sea-going engineer. This instrument is of especial value at the present time, when it is still an open question regarding the efficiency of the various Screw Propellers now in use, it is a matter of the utmost importance that the absolutely correct Pitch be accurately ascertained, in order to compare their relative merits, as regards slip, speed, &c. After much careful study, the patentee has succeeded in bringing before the Engineering profession an instrument, which for simplicity of construction, easy application, and scientific accuracy, is unequalled. The merest novice can use it, and take the correct pitch to the fraction of an inch. To Superintendent Engineers, Foremen in shops, but more especially Marine Engineers, it is invaluable, as it supplies all their requirements as regards Pitching Spare Blades, taking the Pitch when the ship is in dock, &c., in a few minutes, and entirely dispenses with the use of









Templets, Straightedges, &c. A most important and original feature in this instrument is in the manner of using the Level for obtaining the angle, as it gives the true fore-and-aft line, no matter what the position of the Propeller may be.

Most of such appliances in use at the present time are only clumsy gauges, more or less inaccurate and unreliable. Its principle of construction is mathematically correct, viz., that of forming a right angle triangle on the Screw Blade; and its perfect accuracy can be tested and verified by simply measuring with a foot rule the three sides of the triangle. The Leg marked in diameters represents the perpendicular, the Pitch-line the base, and the opposite Leg the hypothenuse, the two former being divided off to a scale of parts. The Leg is marked off as diameters (for convenience), but actually the distances are the circumference of circles due to these diameters, divided to a half-inch scale, the Pitch-line of course being similarly divided. It is made to larger or smaller scales as required. Also by pointing two pieces of small rod, and inserting them in the stops it can be used as a pair of Trammels, or large Compasses; it can also be used as a Straightedge, and if the Level is put parallel with the line marked Square-line, the edge of the Blade is exactly plumb. Thus the instrument can be used for other purposes, as well as being complete in itself for all that is required in marking centre lines on Spare Blades, or taking the Pitch of Propellers. To Engineers when abroad, and who may require to go into a Foreign dock (as is often the case) for the purpose of replacing Blades carried away, it is invaluable, as by having this instrument with them they are rendered independent of any outside assistance or expense whatsoever.

This instrument is worthy of attention—as it is ingenious, useful, and, at the same time, mathematically correct.

NAUTICAL INSTRUMENTS.

Among the chief exhibitors of this class were Messrs. Henry Hughes & Son, who exhibited amongst their large collection the following noteworthy instruments:—

A Deviatometer or improved compass corrector, for showing the magnectic course a vessel is steering, the difference between which and the ship's compass gives the deviation on that course.

The instrument is composed of a horizontal dial divided into degrees, suspended by the usual swivel joints, on it is pivoted a needle, distinguished by a blue and red end. Upon this dial plate and in the centre of and at right angles of two opposite radii, are two inverted sectors divided into degrees of latitude, and provided at the sides with pointers. On the top of these is horizontally fulcrumed the hour dial with a sight vane swivelled to it on its centre.

To use the instrument, the needle on horizontal dial is set to the degrees of variation, east or west, the red end being used in N lat., and blue end in S lat.

The pointers are then set on the latitude sectors, and the index on the sight vane set to the apparent time at ship; the dial is then revolved until the shadow of the wire in the sight vane falls upon the slit at the opposite end, the compass will then show the magnetic course of the ship. The instrument can also be used with the Pole Star.

A novel and complete form of salinometer, comprising an improved copper pot, provided with a large wooden handle to prevent scalding when drawing off, a gilt metal salinometer, a glass ditto and a thermometer, the whole of which, when not in use, pack in the copper pot above mentioned.

Yacht clocks that strike the 8 bells, also combined clocks and barometers for ship's use.

Of sextants and quadrants there was a special display, and were excellent examples of highly finished work.

Improved marine aneroids, their special features being a very open range, and a rack index.

We may add, in conclusion, that Messrs. Hughes have lately added a new department to their business, to supply really excellent water or oil paintings of vessels, with which view they have engaged the services of the well-known artist, Mr. Neville Cumming, some of whose paintings were exhibited.

THE UNITED ASBESTOS COMPANY

had a most interesting exhibit of their well known goods, from the raw material to every kind of finished article.

The uses to which this mineral is and can be put, are most varied, and cover almost the whole field of the applied science, it being manufactured, in almost every conceivable form.

It is a most perfect fire-resisting substance, and is capable of being made into paints, so that any inflammable article coated with it is rendered practically fire proof, its use on shipboard for coating all exposed wood surfaces, &c., should be very extensive. If this were carried out, and all wooden cases or coverings of merchandise and cargo were so prepared, that terrible a fire at sea, would be impossible.

For packing of glands, of engines, acid pumps, chemical machinery, &c., it is most invaluable, as it is not decomposed by excessive heat or acids; it is also self lubricating.

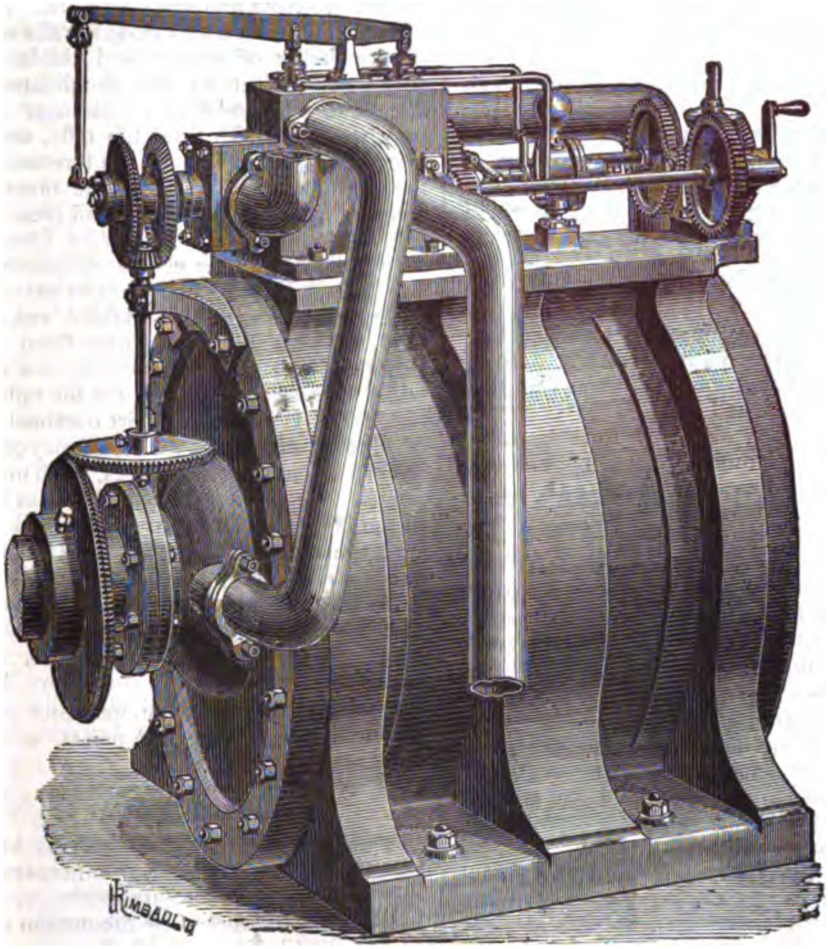
It is also made in millboards from 1-16 in. to 1 in. in thickness, and in the form of putty or cement, it is excellent for making joints, the board can be easily cut into any required form, its chief advantage being the facility with which a joint can be made and unmade, practically any number of times.

As gas checks for signal rockets it has quite superseded ebonite and ivory, which used to crack and split, the pressure on its base at moment of ignition being as much as 3½ tons per square inch, the cartridges or cells are also made of the same material.

One of its latest adaptations is its use as a drop curtain for Covent Garden Theatre, to be used in case of fire, to which it is impervious; it is worked by an Asbestos rope, both being woven from the raw material.

As an insulator of electricity it is not surpassed, and it is used largely as a flooring round dynamio machines, as a covering for electro shunts where great heat is developed, as an insulator between the successive coils of wire on armatures, trays for catching the hot carbon ash from electric lamps, &c.

Although its use is so widely diffused, there is no doubt but that as science progresses still further, uses will be found for this most wonderful of nature's products.



ROTARY ENGINE by M. A. BROSSARD.

M. A. BROSSARD, Swansea,

exhibited a rotary engine. This engine is comprised of two cylinders, one enclosing the other, and a main shaft carrying a piston. The ports of the outer cylinder for the ingress and egress of the steam are situated at the bottom. The second cylinder, being of less diameter, is placed eccentrically within the outer cylinder, but being longer than the outer cylinder its ends work in grooves in the covers of the same. These grooves touch the bottom of the outer cylinder, and clear the upper side of the shaft on which the piston is mounted, thus permitting the small cylinder to turn under the impulse of the piston, but obliging it to rotate about an eccentric axis. The small cylinder is slotted throughout its length, to allow of the passage of the piston as shown, the piston acting in both cylinders. The main shaft occupies a central position in the large cylinder, the piston is fitted with metallic packing, forced into contact with the surfaces against which it works by steam pressure. The ends of the piston shaft are made hollow to admit of the steam passing into the small cylinder from the large cylinders, and the piston always presents a constant area to the action of the steam. M. Brossard's governor is an important feature in this engine. It is designed to control the engine by throttling the steam, or by controlling the degree of expansion. We shall give in our June number sectional illustrations with fuller particulars.

MESSRS. BINKS, BROTHERS, Millwall.

Inventors and manufacturers of wire ropes, had a most interesting exhibit of all kinds of wire hawsers, ropes, rigging, &c.

First and foremost we noticed the first piece of wire rope ever made in England, manufactured in the year 1835, at Great Grimsby, by the late Mr. George Binks, father of the present proprietors.

Of hawsers, of which there were a number, the two most noteworthy samples were, one of 17 inches, and the other 32 inches circumference, and with a breaking strain of 650 and 2,000 tons respectively.

Patent steel flexible wire rope, towing hawsers, and mooring ropes, were shown on double and single purchase reels, and patent nipper or controller; also patent steel flexible wire rope for running and driving gear, cargo and purchase falls, &c.

Samples of ship's standing rigging made on the formed rope system, and which has been over the mast heads of several well known ships in constant wear for 22 years.

Wire rope lanyards, knotted complete, flexible wire torpedo rope.

A most novel form of armour plate bolt was shown, made of a stout piece of steel wire rope, the object of the invention being, to prevent the head of the bolt flying off, by reason of the concussion of the shot which so oftens happens with the ordinary bolt, and we have no doubt it would be effective.

A large show case from the Exhibition of 1862 was also shown, containing the various makes of wire and steel rope, from the smallest cords to the largest ropes, and some of the medals gained by the firm for excellent workmanship, which judging from the class of work were well placed.

Messrs. JOHN CRAN & Co., ENGINEERS, &c., Leith, N.B.,

exhibit a whistle for signalling purposes, shown now for the first time. Its peculiarity consists in the operator being able by its use to sound all the notes through two or more octaves, or from a very low to a very high and shrill note; or continuously rising and falling notes. The whistle also gives out long or short notes at the pleasure of the operator, and is thus adapted to all kinds of signalling at sea, by day, night, or in foggy weather—besides being suitable for indicating steering courses—with a universal code as is in use for flag or ball signals, or telegraphing, it may be made of the utmost service in lessening the chances of collisions.

Messrs. Cran's other exhibits are—Thomson's Patent Metallic Air Pump Valves, now being largely used as a substitute for rubber valves, and Ratzenstein's Metallic Packing for Piston, Valve, and Pump Rods. It has been successfully used by most of the large Atlantic Companies, being a great advance on soft packing in point of economy and durability.

We understand Messrs. Cran & Co. are represented by Mr. John C. Anderson, of 114, Fenchurch-street, London, E.C.

LIFE SAVING AND BOAT LOWERING APPARATUS.

The prizes of 100 guineas and 50 guineas, given by Mr. Samson Barnett, junr., to the exhibitors of the best means of saving life at sea, were awarded to Mr. R. Roper, 143, Lewisham High Road, New Cross, London, and to Messrs. J. and A. W. Birt, Dock Street, London Docks, London.

Mr. R. Roper obtained the first prize of 100 guineas on account of the efficient and reliable manner in which his life saving apparatus could be worked. The apparatus consisted of self-launching bridge life-rafts, built on the cellular principle, for saving life in case of shipwreck or fire; also for landing troops, horses, guns, baggage, and light cargo. These are fitted with mast, oars, sails, compass, signals, watertight seats for containing water, provisions, and everything for sustaining life. They can be launched instantaneously. Working models of various kinds of rafts were shown, fully demonstrating their usefulness in saving and sustaining life. Rafts for carrying field pieces, horses, and troops; rafts with raised cabins for the shelter of women and children, and for other purposes, were shown with the different details of construction. A model of a passenger steamer, of 4,060 tons, was fitted with three life rafts, one in front of the poop deck, one in front of the forecastle deck, and one forming the captain's bridge, the three rafts being sufficient to carry the passengers and crew.

A model of the *Princess Alice*, fitted with rafts with fluted bottoms on the cellular principle, was shown, the rafts being capable of carrying 960 passengers. Another model was shown of this ill-fated vessel with the after part as it sank, but in this case fitted with R. Roper's Self-Floating Rafts. This model was sunk in a tank of water to show the action of the life rafts.

Messrs. J. and A. W. Birt obtained the second prize of £50 on account of the excellency of their well-known life belts, hammock mattresses, berth mattresses, buoyant benches, &c., &c. Their life belts, as worn by the crews of the lifeboats of the Royal National Lifeboat Institution, the waistcoat pattern as used by the Trinity House; the Board of Trade regulation pattern as used by the Admiralty and principal shipowners; hammock and berth mattresses for men-of-war, passenger ships, and ordinary merchant ships; cushion life belts, buoyant benches, camp stool and bulwark life buoys, rafts formed with spars and mattresses, and other life saving apparatus, claimed a large amount of deserving attention.

Messrs. MACKENZIE & VIVIAN.

The Dual engine, by Messrs. Mackenzie & Vivian's patent looped cross-head or bifurcated piston rod for obtaining concentric rotary motion without cogwheel or belt-gearing, is worked by the motion of the drag or slot block around the shaft with as much facility as in the ordinary slotted cross-head used for pumps, etc.; where space for a connecting rod is not available, but with the novel feature that, instead of the block actuating a crank pin at the extremity of a shaft, it may be thrown around it at any desired point, thus enabling two concentric rotary motions to be obtained without gear for a single rectilinear one. When concentric rotary motion is required, but not at uniform speed, the male or inner shaft may be driven by ordinary connecting rod, and the female or outer shaft by a single looped cross-head; but where uniform rotary speed is necessary either in one or opposite directions, the dual-looped cross-head or bifurcated piston rod is used. Most of the experiments made during the past seven years with this engine have been for marine propulsion, where speed and straight course are necessary, by the employment of right and left-handed screws rotating in opposite directions. There are many other uses to which the plan may be applied without cumbrous and noisy cog or belt gear, and at increased speed if required.

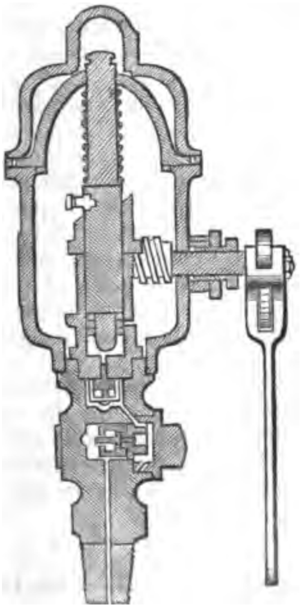
Messrs. Mackenzie & Vivian's steam dual capstan and rope pinch combined is self contained, either drum being rotated at will independently, enabling one man to attend to two cables, steering or hauling on either or both, and having control, through the lever-handle and foot-brake, over both the steam power and the cables. Messrs. Mackenzie & Vivian also exhibited patent single and double D pumps, with ordinary valves actuated by eccentric, every part easily got at. These pumps could be worked without injury in the most dusty stoke-holds, even if coals were thrown over them. The suction and discharge ports are readily arranged on either side to suit the lead and position of the pipe.

PROPELLER LUBRICATOR.

(Marchant's Patent.)

Mr. Crampton, of Tower Chambers, Moorgate Street, exhibited a large variety of these novel forms of lubricators, which, as their name implies, propels the lubricating matter into the valve chest, cylinder or other vessel, even against a pressure of 200 lbs. to the square inch.

They can be used for high or low pressure steam without any regulating, and are not dependent upon vacuum, vibration or gravity.



Upon reference to the accompanying sectional drawing, it will be noticed that the working parts consist of a ram or force pump, the barrel of which is fixed in the centre of the cup.

The barrel is perforated with a circle of holes, through which the lubricating matter flows by its own weight to charge the cylinder, immediately the piston has risen above them.

The up motion is imparted to the piston by means of a stud screwed into the side of the same, and on which is mounted an anti-friction roller.

This roller rotates upon the vertical edge of a cylindrical spiral cam attached to a worm wheel, which derives its motion from a worm upon a side spindle, furnished at its outer end with a lever, pawl, and rachet wheel, which is actuated from some reciprocating part of the engine or machine.

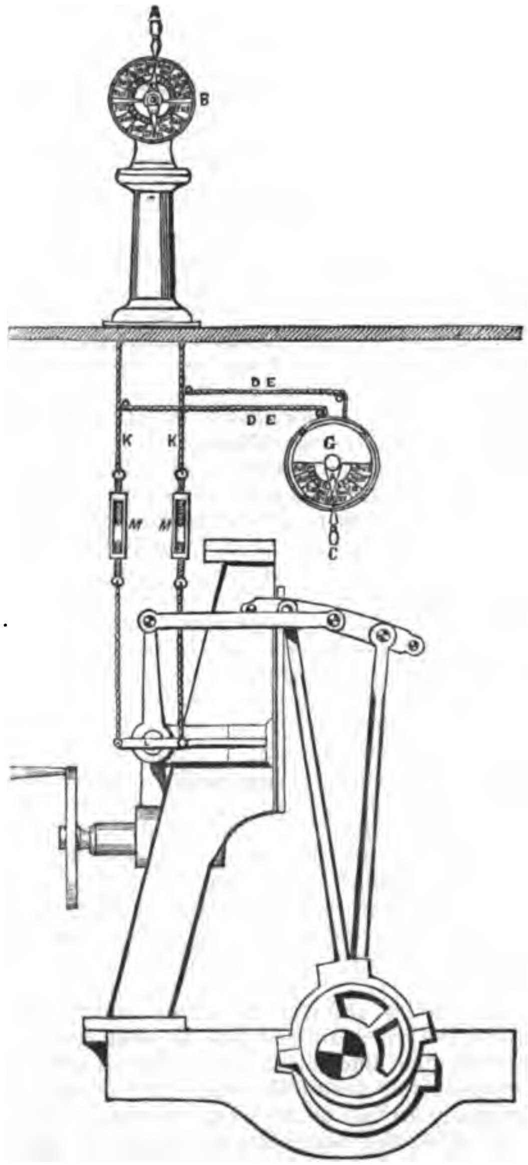
When the roller has reached the end of the cam the piston is suddenly forced backwards by a coiled spring which encircles it, and which is confined between the shoulder, seen on the piston, and a guard fixed to the top of the cup, thus causing the oil or other matter contained in the cylinder to pass through the back pressure valve underneath the barrel.

This valve, and the one shown in the square of the body, entirely prevent any steam from gaining access to the cup, as well as any return of any oil which has been forced through them.

We may mention that these lubricators are largely used by the General Steam Navigation Co., Platt Bros., W. Joynson & Sons, and others, all which give great satisfaction.

A. H. KUHLMAN, 21, Great St. Helen's, London,

exhibited a patent speed-timer, which keeps the officer in command of a vessel informed of the speed at which the engines are running. The water pressure acts on a plate and is conveyed to a hand dial. Bevel gear is fixed on the engine shaft and connected with the axle which is set in motion by the engine. The propeller is



placed in a box which is filled with water mixed with glycerine. The motion of the engine driving water to the pipes, shows the amount of pressure both on the bridge and in the engine room. This pressure is indicated by a pointer in each case. Mr. Kuhlman also exhibited an automatic and bridge telegraph for transmitting orders from the pilot or officer in charge to the engine room (as shown in Fig.), consisting of a handle, A with a pointer moving over a dial (B), and communicating by light chains (DE), with the dial (G) in the engine-room.

The automatic reply apparatus comprises an index and pointer on the standard or deck which is in communication with the lever (L) by means of chains (KK). Lever (L) is fixed on the way shaft of the engine.

Mr. F. C. WINBY, Palace Chambers, Westminster,

exhibited the Gallafent engine, which possesses many advantages. It may be driven at any speed varying from 15 to 2,000 revolutions per minute, it may be reversed at its highest speed instantaneously, is worked expansively, and and as a compound condensing engine, is perfectly balanced and self-contained. In this engine cranks, connecting and piston rods, slide bars with their eccentrics and other fittings, are all dispensed with, and from the enormous power it will transmit proportionate to its weight and the small engine room it occupies, it will recommend itself for use in steamers, launches, torpedo boats, &c., or for driving direct upon dynamo-electrical machinery, gas exhausters, ship's winches, or for any purpose requiring high speed. The disc is concentric with and fastened upon the shaft. This disc is of such a diameter as to form a partition or inner cover completely separating the two cylinders, and is enclosed, and revolves within a cylindrical chamber of corresponding diameter and width. The disc fits accurately in its chamber so as to revolve steam tight. The duplicate annular cylinder is an eccentric casing to the shaft. The pistons, three in number, are each in the form of a segment of the annular cylinders, in which they are accurately fitted with metallic rings, or packing, to revolve steam tight. These pistons are in duplicate sets disposed symmetrically at opposite sides of the disc, to which they are connected in pairs in the following way:—The disc has radial slots extending from near the shaft to near the periphery of the disc, or the distance required to permit of the revolution of the segments or pistons in the eccentric annular cylinders, and yet maintain the connection between the pistons and the disc. There are also pins fitting and sliding in the radial slots projecting in a cylindrical shape at each side thereof, and received in corresponding sockets in the pistons which are thus free to pivot on the pins, and assume the different angular positions with regard to the radial slots due to the eccentricity of their orbit. There is no partition or abutment for the steam in the cylinder itself, the steam pressing equally on the front and rear faces of consecutive pistons, but with unequal effect, owing to the greater leverage due to the greater radial distance from the shaft of the one piston than the other.

LE GRAND & SUTCLIFF

exhibited a large assortment of wrought and cast-iron piles, and gear connected therewith, embodying a novel and ingenious method of constructing and driving piles for submarine and other purposes.

The departure from ordinary practice, consists in making the piles hollow, of wrought or cast iron, the lower ends being made solid, pointed and generally steel-tipped, and instead of the blows being delivered on the head of the pile the driving force is expended just where required, viz., at the point. The monkey is a cylindrical one, and works inside pile, so that it forms its own guide; the joints are made by barrel-shaped steel sockets.

At first sight it might appear that the monkey delivering its momentum to the pile at the bottom, would tend to pull such a pile in two at one of the screw joints, by reason of the inertia of the metal above; in practice, however, this is not the case. We may add, however, that the points are slightly bulbous, which thus causes it to do all the work, leaving but little frictional resistance for the joints that follow.

One advantage of this system of pile-driving is the facility with which they can be sunk in deep water, as it is only necessary to connect a sufficiently long length to reach the bottom, when driving can be proceeded with, additional lengths being added as required; additional stability is given in some cases by the use of a flange, so adjusted that it just embeds itself on the river bottom.

For heavy columns, three piles of moderate dimensions are preferable to one of larger diameter, and connected together by a triangular flange which supports the superstructure.

For artesian wells the bottom length is perforated, the water being kept from rising in the tube, during the sinking, by a plug with a movable screw, between the first two lengths from the bottom—in which case the blow of the falling monkey is given to the screw.

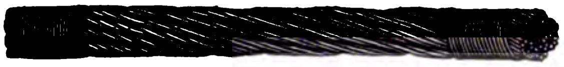
MESSRS. GEO. CRADOCK & Co., of Wakefield,

exhibited one of Taylor's Patent Capstans, for working the anchor by means of wire rope and chain, which we illustrate in Figs. 1 and 2. It can be worked by manual labour, by a messenger, from steam winch, or by a separate engine, as may be desired. It is provided with a store drum for taking on sufficient rope for one anchor, which can be placed beneath to allow of the rope coiling on store drum. The drum is provided with a friction cone, and is kept moving a little in advance of the pulley heads, thereby keeping the rope sufficiently tight between the pulley heads and drum to give the necessary gripping power. The drum is also provided with a powerful brake, so that, if necessary, the ship can ride by it, and the friction gear is easily adjusted to allow a little rope to be paid out, and so reduce the sudden jerking in a rough sea. The rope passes twice over the pulley head, forming the figure 8, but can be taken off and on as readily as belaying a mooring rope on a pair of common riding bitts without kinking. These heads are each provided with friction cones, and admit of the rope being firmly taken hold of without in any way injuring it, and by loosening the friction cones and keeping control of the brake the anchor can be let go with facility. A series of experiments have recently been made with the Capstan under notice, which has been made for a ship of 1,350 tons register, and the results were of the most satisfactory kind, and has been passed by Lloyd's Committee.

The same firm also exhibited coils of White Manilla Rope, Bolt Rope, Lanyards and Russian Cordage, also Tarred Manilla for trawling purposes.

This firm also exhibit samples of Steel Wire Ropes, made on Lang's patent, suitable for Railway and Mining purposes. This firm are the sole manufacturers of this patent rope, which they introduced to the public in December, 1879, and claimed the following advantages for it, viz :—

"By an improvement in construction of round and flat ropes, we have a much longer surface of the wire exposed to friction, and lessen, if not entirely remove, the cause of wires breaking on the crown of the strands, and as the working of the rope round drums, pullies and curves bends the wires in an oblique direction, we thereby secured the greatest amount of wear from the wire that is possible, as the wires will not break until they become too much reduced in strength, and therefore too weak for their work.



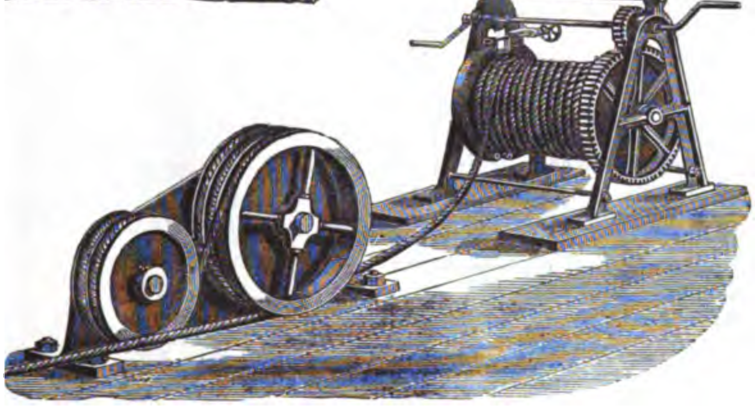


Fig. 1. TAYLOR'S PATENT HOLDER.

"The wires in the strands on this principle have a very much longer bearing one against another than in the ordinary system, and we are thereby enabled to prevent the great injury resulting from the wires in each adjoining strand cutting into each other. We therefore claim for this rope a greater durability than can be obtained by any other construction."

Very large numbers of ropes have been made on this patent, and they have been most successful, the result being that they have done a greatly increased amount of work over the old construction, and the firm have sustained their claims. A sample is shewn at their stand of a haulage rope which has worn from ¾-in. to ½-in. diameter. The surface resembles that of a bar of iron more than that of a rope, being worn quite smooth, and there is not a break or fracture in the wire anywhere.

This firm also exhibit samples of Galvanised Flexible Steel Hawsers, made from the highest class of steel wire, carefully selected, and guaranteed to be fully equal to Lloyd's requirements. In connection with their steel hawsers they exhibit Taylor's Patent Holder, which we illustrate in fig. 1, and for which they claim the following advantages :—

"1st.—The rope is not held hard and fast as is the case where nippers are used, but the pulley heads being grooved to suit the rope required, crushing or bruising of the rope is avoided; they are adjustable to any required strain, the friction yielding and acting in lieu of a spring preventing injury to the hawser.

"2nd.—Each holder is provided with store drum, is simple and compact, rendering it unnecessary to handle the rope.

"3rd.—Paying out stock rope is effected by easing the frictions, which allows it to run out freely without handling."

It is expected that with this apparatus the breakage of towing hawsers can be obviated, the maximum strain imparted to the rope, even in a heavy sea, being capable of adjustment with any unskilled labour.

RIDSDALE & CO.'S

show of ships' brass work, steam fittings, hot water and heating apparatus for ships and domestic use, and all kinds of lanterns, &c., was so extensive that we cannot do more than briefly notice it.

As regards ships' fittings and articles for the general outfit of the navy, mail and ocean steamers, there were many valuable and interesting objects shown.

The bow and masthead lights, made under Thomas's Patent, showed with remarkable effect the simplicity of the system and results obtained, attracted considerable attention.

We may also mention the excellent reading lamp, Thomas's Patent, called "The Albany Lamp," and which has been supplied to Her Majesty the Queen.

Although not strictly in keeping with a Naval Exhibition, there were several lamps for railway purposes, all giving powerful and economical lights.

Taking the exhibit, as a whole, it certainly gave us the impression of being a high class one—the elegance of design and quality of work leaving little to be desired.

MR. MAIGNEN,

patentee of the "Filtre Rapide," exhibited a great novelty in the Hydraulic Lifting and Sliding Jack—its use being that the heaviest weight can be lifted by it, and transported by an exceedingly small expenditure of power.

Its construction is as follows:—An ordinary hydraulic cylinder, open at both ends, has a plunger or ram of the usual form working in it; at the bottom is an L-shaped leather, which makes the joint on the surface it may be standing on. The weight is lifted by pumping water into the cylinder.

The weight now being supported by a column of water resting on the surface of the plates along which the weight is to be transported, it can be easily moved, owing to the very slight friction between the water and the plate—a constant film of water being kept between the sliding surfaces. We must state this invention is only in its infancy; but, no doubt, under the direction of Mr. Maignen, practical uses for it will shortly develope themselves.

Mr. TURNER, Barking Road,

exhibited a tube stopper, its chief difference to others being that the joints are made on the outside of the tube, on tube plates, with asbestos or other packing. The front washer that forms the joint is in two halves, hinged together, and to the rod, by means of which it is put into position and held in place; eccentrically on this rod is a short cylinder of iron, loosely fitting the tube, which acts as a guide; to put the stopper in place it is inserted in the tube with the hinges uppermost, so that the two halves fall together on being projected through the tube; they are turned through an angle of 180 degrees when they fall open: then by drawing the rod back, pushing a similar solid washer up to the tube at front end, they can easily be screwed up tight, the operation taking only about one minute.

JOHN AND EDWIN WRIGHT,

London and Birmingham, had an excellent show, and exhibited almost every variety of the extensive assortment of iron, steel, and hemp ropes they manufacture.

They had seven show cases, in the principal of which were exhibited sections of steel cables and hawsers, such as they supply to the Admiralty, the largest being 8 in. circumference, with a guaranteed breaking strain of 160 tons. In this case also were samples of beautifully-formed hemp and Manilla ropes.

In the other cases were numerous varieties of iron and steel ropes for mining and engineering purposes, transmitting power, steam ploughs, running gear, etc.; also some extremely flexible steel wire ropes for working over small sheaves, and of which we would make particular mention, as they are made of such flexibility that they will coil perfectly upon diameters of 6 in. or less, and, in fact, are more flexible than hemp ropes of equal strength, and only one-fourth the weight.

Samples of ropes supplied to the French and other Governments for aerial tramways were shown.

They exhibited, in a large coil of over 3 tons weight, an improved galvanized steel wire hawser (as supplied to the Admiralty), 300 fathoms long and 5 in. circumference, which had been tested without breaking to 70 tons. Another fine sample was one of their improved galvanized steel wire hawsers, of same circumference and breaking strain, and which had 12 outside strands of 19 wires each, so forming a perfect circumference.

Their show of ropes, also, was most creditable, amongst which were a 7-in. circumference Manilla trawl rope, a 6-in. tarred Russian hemp rope, and an 11-in. white Manilla, tested by Admiralty to 45 tons.

Lastly, we must not omit a length of large coil rope labelled "Jumbo," which is the largest rope ever made, being 3 ft. 6½ in. circumference.

In addition to above, Messrs. Wright also exhibited three kinds of nippers, or stoppers, of different patentees, viz., Harfield's, Archer's, and Mitchell's, the first being exclusively used by the Admiralty.

THE BOWER-BARFF RUSTLESS IRON CO.

exhibited a large variety of works of art, in iron, which had been subjected to the above anti-rusting process, some of which had a very pleasing appearance, being of a French grey tint, others being of a dull black; the former is that derived from Messrs. G. and A. S. Bower's process, the latter from Professor Barff's; the salient points, however, of both systems produce pretty nearly the same visible results on the iron or steel operated upon, the chemical change being practically the same.

There is no doubt that the application of these processes will prove of great utility to users of iron and steel, as at a trifling cost any article can be preserved from deterioration. To wholesale iron houses and exporters it should prove invaluable.

The application to naval engineering is governed, at present, more by mechanical than commercial difficulties, there being no difficulty in preparing ships' plates or ribs, as plate, bar, angle, or T iron; the difficulty being to treat them when they collectively represent parts of a ship; but no doubt many, if not all, such difficulties will disappear with the advance of engineering and other kindred sciences.

There is no doubt that the process is eminently adapted to all the smaller details of a ship's equipment.

The Company, we understand, are prepared to treat goods, the dimensions of which should not exceed 9 ft. by 3 ft. by 2 ft.

JOHN SHAW, of Sheffield,

patentee and manufacturer of the Yorkshire Wire Rope and Fencing Work, exhibited a very fine case of wire ropes of every description, from 1-16 in. to 12 in. circumference, compressing patent flexible steel wire hawsers, galvanized wire ropes for ships' rigging, log lines, and halyards; also a portion of an immense cable for lifting wrecks, etc. This rope is 9 in. circumference and has a breaking strain of 250 tons. There were also specimens of every description of steel, and iron wire ropes, for mining purposes, inclines, aerial railways, etc. The wires for these ropes are all carefully tested before using, so as to ensure their being of the first quality and strength.

Mr. Shaw also exhibited some plans of a very light and

FIG. 1.

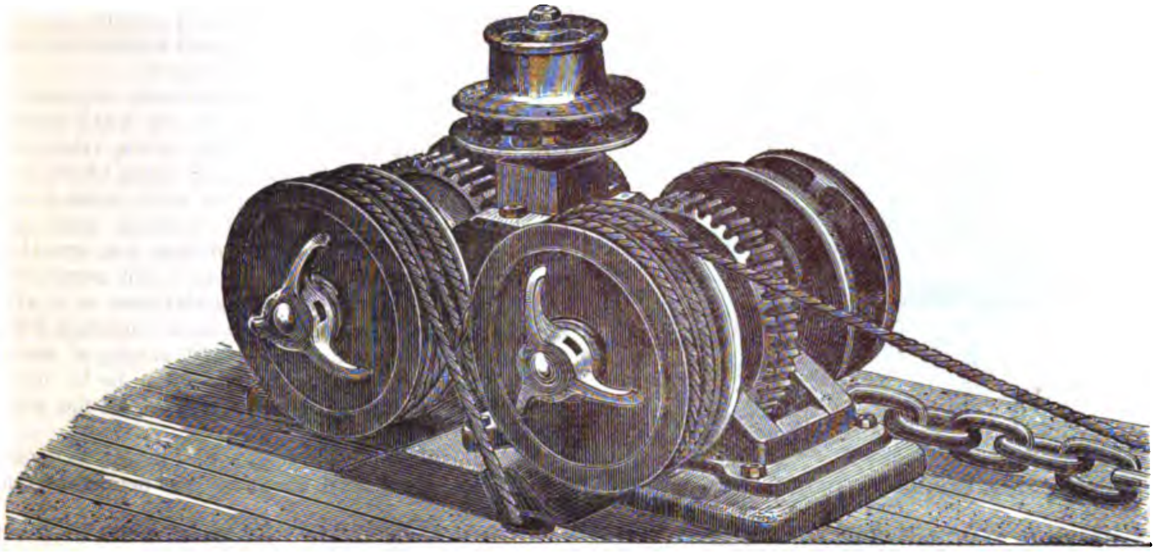
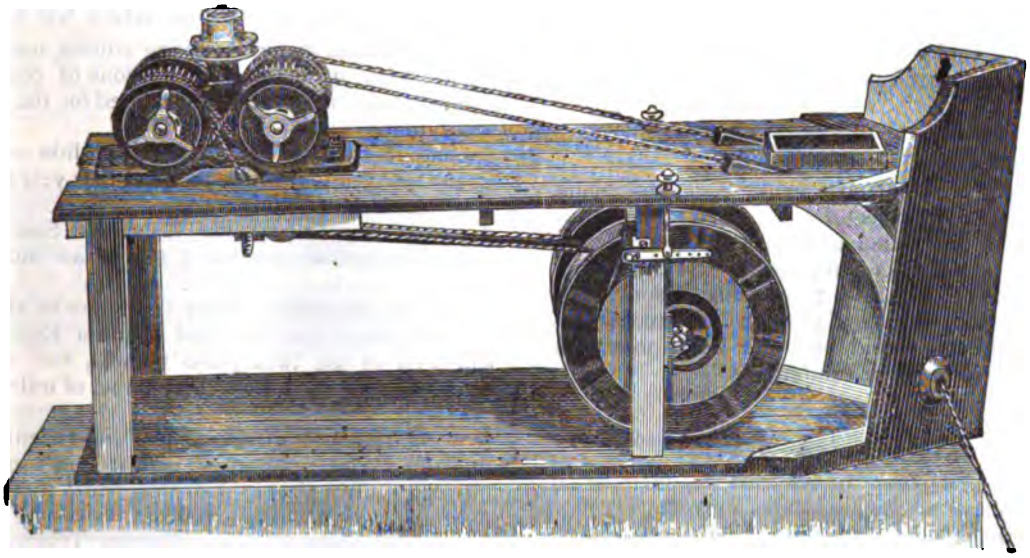


FIG. 2.



TAYLOR'S PATENT CAPSTANS.

(*For description see page* 44.)

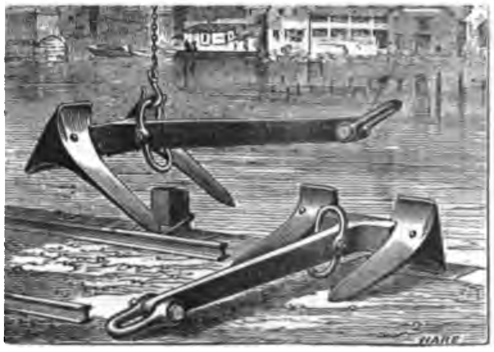
strong wire rope suspension bridge, galvanzed wire rope truck tow or bullock trace, and a patent lock wedge fence for ostriches and cattle.

Altogether, this exhibit was a most complete and interesting one.

Mr. WASTENEYS SMITH, of Newcastle-on-Tyne, exhibit, at Stand No. 316, several of his Patent Stockless Anchors. One of these is an anchor of 5 tons, intended for H.M.S. *Agamemnon*, and it is exhibited by permission of the Lords Commissioners of the Admiralty. To show the method of stowing, there is also exhibited a model of the *Agamemnon's* bows fitted with a model of the anchor to a scale of 1 inch to the foot. Two other types of this anchor are also exhibited, viz., the "mercantile type," as supplied to the merchant service, and a special type for yachts, steam launches, &c. A special type of this anchor is also made for permanent moorings.

As the name implies, and is shewn in the following illustration, this anchor has no *stock*. The shank and crosshead are forged in one piece and the arms separately, and they are attached by a spindle passing through the crosshead, the various parts being very carefully machined and finished.

The success which has attended this invention—about 500 anchors being already in use—seems to have satisfactorily settled the question that it *is* possible to make "*a thoroughly reliable anchor without a stock*." The stock, though an indispensable part of an ordinary anchor, is really a dangerous encumbrance, so that this invention is a real practical benefit to the maritime world. Apart from this—judging from reports received by the patentee—the efficiency of the anchor is greatly increased, as the liability of fouling the cable is altogether removed, shorter cable is required, the anchor takes hold more quickly, holds more tenaciously, and trips more easily than any other form of anchor. In addition to many ships of the Royal Navy to which these anchors have already been supplied, the patentee is now making anchors of three tons and six tons for H.M.S. *Amphion* and *Collingwood*. He has also supplied several for foreign navies, while the Cunard, Union, and other large companies regularly use them.



Messrs. J. KING & CO.,

of Three Colt Street, Limehouse, exhibited a clinker-built surf boat, 21 feet by 5 feet by 2 feet 3 inches, teak planked, English oak, frame and knees, copper fastened throughout, brass rowlocks and plates. Also two clinker built Dinghies, 11 feet and 7 feet long, respectively, turned out in a state worthy of the firms' old-established reputation. We understand all these boats met with ready purchasers during the exhibition.

A. H. BATEMAN & CO.

showed several novelties in addition to their usual interesting goods of machinery, forges, fans, &c.

The most noticeable was Snowden's screw making machine, which is an attachment for an ordinary drilling machine, and capable of forming screws any size and shape from ¼ inch to 1 inch diameter, and ½ inch to 6 inches long; the bolt being formed, pointed, headed, and screwed true to gauge in two operations. These machines are largely used in H.M. dockyards and private firms, giving great satisfaction--one chief advantage being the rapidity with which changes can be made from one size screw to another.

We also noticed a new kind of direct acting pump of E. D. Barker's patent, (the inventor of the hydraulic brake). This pump had no dead point, the mechanism being the exterior, it is easily accessible. Another of his patents was exhibited in the form of a clever hydraulic reversing gear for marine engines; it being controlled by one small handle, and dispensing with the link motion.

A useful novelty in the way of a boiler tube cutter was shown, its advantages being, that defective tubes can be cut out rapidly from the tube plate without withdrawing the tube—the tool being held by a very ingenious arrangement; the cutter is inserted and withdrawn from the outside, a gauge and pointer even shows the depth of the cut that is being taken.

Lastly, we must mention an extremely ingenious but simple lock-up steam or water-valve, which at a very slight cost can be fitted to any ordinary globe valve. The valve is provided with two ordinary mitre valves, one of which can be used for shutting off while under pressure, thus permitting the ordinary working parts being removed, and even repaired, without the vessel being emptied to which it is attached; to steam users it should prove invaluable, as also to householders, as it will go far towards removing one of the most important difficulties in connection with the constant supply of water, as it will enable a defective or leaky tap to be repaired without necessitating the emptying of all the cisterns with which it is in connection.

For valuable liquids it is also very useful, as it can be locked up by a special key, and thus peculation can be prevented.

In all, this exhibit reflected great credit on the proprietors.

THE PHOSPHOR BRONZE CO.'S

exhibit, comprised many interesting articles, inasmuch as a large number of these were portions of engines and machines which had been dismembered for the purposes of exhibition.

Among these may be remarked, a slide valve face from the s.s. *Poonah*, which had had four years wear—it was in excellent condition.

A pair of brasses from the Ebbervale Steel Rolling Mills, which had been reduced to ⅛ of an inch at the own.

A pair of locomotive slides from one of the North Eastern Railway Co. Standard Express Locomotives; it had been in use twenty-two months, and only worn 1/32 inch, the face being perfect—number of miles run are 78,277.

A piston ring from the Peninsular and Oriental Steam Navigation Co.'s s.s. *Gwalior*, had been in use nineteen months; it is 52 inches in diameter, and ⅛ inch thick.

A propeller bolt of H.M.S. *Cleopatra*.

A pair of brasses from the Eastern Telegraph Co.'s s.s. *Chilton*, which had been eight months in use; the tool marks however, were still visible.

Besides the above were exhibited several other objects showing the uses to which this excellent material can be put—such as spiral springs for safety valves, wires for telephones, *forged rods*, steam fittings, sheathing for lining the hulls of wooden ships, hydraulic presses, and general works of art.

Messrs. PEACOCK & BUCHAN, Southampton.

had an excellent show of their Specialities.

The anti-fouling composition used for the bottoms of iron or steel, wood and sheathed vessels, and which is largely adopted, was exhibited in the forms they deliver it from their works, packed in iron drums, and in quantities varying from a quarter to one cwt. for export, and from three lb. to twenty-eight lb. for home use.

Their ready-made innocuous non-poisonous paints were exhibited in about 30 different colours. The chief advantages claimed are, that they are entirely non-poisonous, no white lead being used in their manufacture; dry in a few hours and have a brilliant gloss; are very finely ground, and so their covering area is increased; have no unpleasant smell, and do not require any turpentine or oils for thinning. It is stated they will keep in their tins for years without any deterioration.

Anti-corrosive metallic paint for priming was also shown, and recommended for all descriptions of iron work not submerged in salt water.

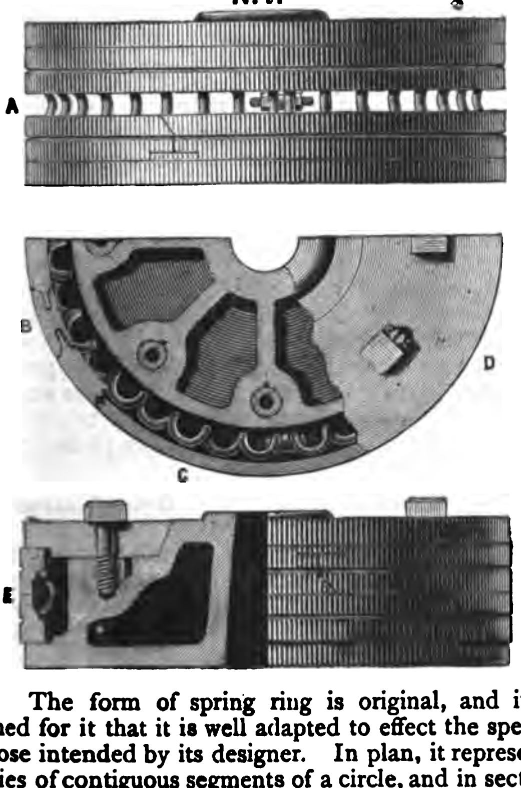
We may mention that Messrs. Peacock & Buchan's anti-corrosive compositions have been constantly used for 25 years by the British and Foreign Admiralties, the India Board, Crown agents for the Colonies, and others.

The ready-mixed innocuous paints being largely used for "sea stores," chiefly to prevent the danger from fire, and damage to the cargoes.

Messrs. LOCKWOOD & CO., Sheffield.

Exhibited their Mr. Lockwood's patented Improvements in Pistons and Piston Packing, which is worth notice by our practical readers. These improvements consist in a new form of packing ring and spring ring. The packing ring is in two parts, its special form being shewn in section at *E* in our illustration of this invention. The form of spring ring is original, and it is claimed for it that it is well adapted to effect the special purpose intended by its designer. In plan, it represents a series of contiguous segments of a circle, and in section as shewn also at *E*, a single segment of a circle. Being made of round steel wire, of equal section all through, and in one length, for any diameter of cylinders it should be elastic at all points.

Nº I.

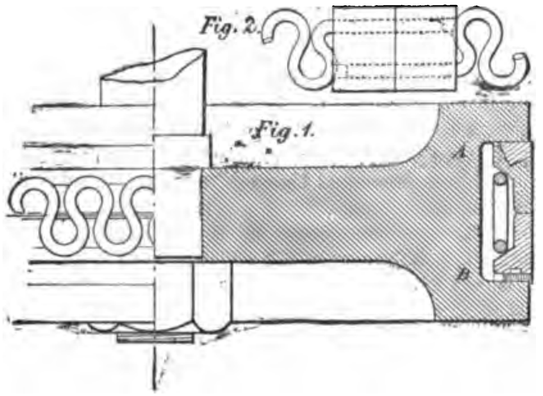


The special form given to this spring was designed that it might have two distinct actions when in place in the piston; one to press the packing rings radially against the walls of the cylinder, and the other to press them upon the flat surfaces of the junk ring and piston flange, these pressures being made adjustable by distance pieces at the spring ends.

Our illustration shews so clearly the general features of this invention, that it needs no further description at our hands. We are glad to hear that these pistons have been very successfully applied to a large number of land engines, and that their merits are being appreciated for marine purposes by some of the largest of our steamship companies and marine engineers.

Messrs. BEVERLEY & ATKINS, of Sheffield,

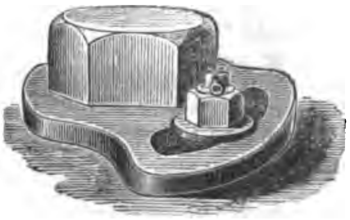
Exhibited Prior's patent Piston Rings and Spring. Here the piston ring is also in two pieces, each half being of the ordinary *L* section, and fillited so as to receive the special spring proposed by its inventor. This spring is formed of best cast steel wire, formed into bows—as shewn in the illustration—which are placed very close together, with the intention, in case of any priming in the cylinder, that they shall touch each other, and so form as it were a compact ring to resist the extra pressure caused by the presence of water. One feature of this invention is, that these packing and spring rings can be fitted to the old form of pistons, they taking up no more room than has been the custom hitherto to provide.



The ordinary defects of leakage and deterioration of the packing, common to the old form of pistons, has in this, as in Mr. Lockwood's invention, been overcome by the peculiar action of the spring—although of different form—in each case giving out pressure to the packing rings in the directions most needed.

In fast moving engines of small size, great risks are run in those cases where the pistons are fitted with ordinary junk rings, by the giving way of the junk ring bolts. To meet this objection, solid pistons are supplied by the makers of Prior's invention, fitted with his patent rings. But in cases where such pistons could not be used, as in marine engines, Messrs. Beverley & Atkins have adopted an improved form of Bolt Head Guard.

Of this Guard, we give an illustration which almost explains itself. It is made of iron or brass, and permits the bolt or nut to be properly tightened, and then holds it in any position—by means of the stud, nut, etc. shewn—limited, of course, by the length of the slot formed in the guard. There is little risk of any part becoming loose if the parts of the guard are well made and properly put together.



THE NORTON HOUSE AND SHIP VENTILATOR

This apparatus was shown in action, both as a model fitted to a ship, and full size, suitable for house ventilating purposes.

It may be briefly described as consisting essentially of a system of pipes, connected with the apartments to be cleared of foul air, and communicating through a clapper valve with an exhausting and forcing apparatus, composed of a water bell or air-chamber, to which a vertical reciprocating motion is imparted by a beam or other arrangement, operated by an engine or other motor.

The down stroke of the bell forces the air through the same pipe by which it enters, when it is arrested by the clapper valve guarding the exhaust pipes from the chambers, and gets propelled through a second similar valve, to the discharge pipe.

In operation, the rising of the bell forms a partial vacuum, and so draws in the foul air from the chambers with which the exhaust pipes are connected. On the return or downward stroke of the bell the exhaust valve closes, and so the air which had previously filled the bell gets forced out through the discharge valve chamber to the open air.

As the foul air is drawn away from the chambers, pure fresh air is supplied from without.

This apparatus, which has already had several successful applications, such as for ventilating the Criterion Theatre, British Board of Trade's s.s. *Ceylon*, and several private dwelling houses in the United States, should have a wide field amongst shippers and shipping, both in the Navy and merchant service, as by its use there would be no danger of coal gas accumulating, the suffocating of cattle, grain heating, tea sweating, &c.

By attaching the exhausting bell to the stern post of a vessel the action can be made automatic and dependent on the vertical motion of the ship.

RAHTJEN'S PATENT COMPOSITION FOR SHIPS' BOTTOMS.

This anti-fouling composition, of which Messrs. Suter Hartmann & Co. are the sole proprietors, was exhibited on a model of a ship.

Its qualities are stated to be that it dries quicker than any other paint, as three coats can be given in one day; the best protection against rust and fouling matter, and ensures a gain in speed, owing to the smooth nature of the composition.

It has been applied to a large number of steamers, amongst which are the *Alaska*, which is the fastest Atlantic steamer afloat, having made the trip to America in 7 days 4 hours 32 minutes; *Servia*, *City of Rome*, *Parisian*, *Stirling Castle*, *Rome*, *Carthage*, and all the Peninsular and Oriental Steam Navigation Co.'s new boats and others.

FOULGER'S ANTI-FOULING COMPOSITION,

composed of a ferro-manganesic compound, was shown applied to a handsome cutter-rigged model yacht, as also to a half model, showing the "anti-corrosive priming," used under it to preserve the iron.

Messrs. John Foulger & Sons also exhibited specimens of their paints and oils for ships' use and for export; also some washes for steamers' funnels, which, in conjunction with the anti-fouling composition, attracted the attention of a large number of yacht and ship owners.

One noticeable article of their exhibit was a brown enamel paint for coating bricks or woodwork, to render them impervious to damp, and which takes about as many minutes to dry as ordinary paint takes hours.

We may add that the Union Steamship Co., the Royal Mail Steam Packet Co., and others are large users of the above compositions.

Messrs. C. BURRELL & SONS, Cannon Street, London

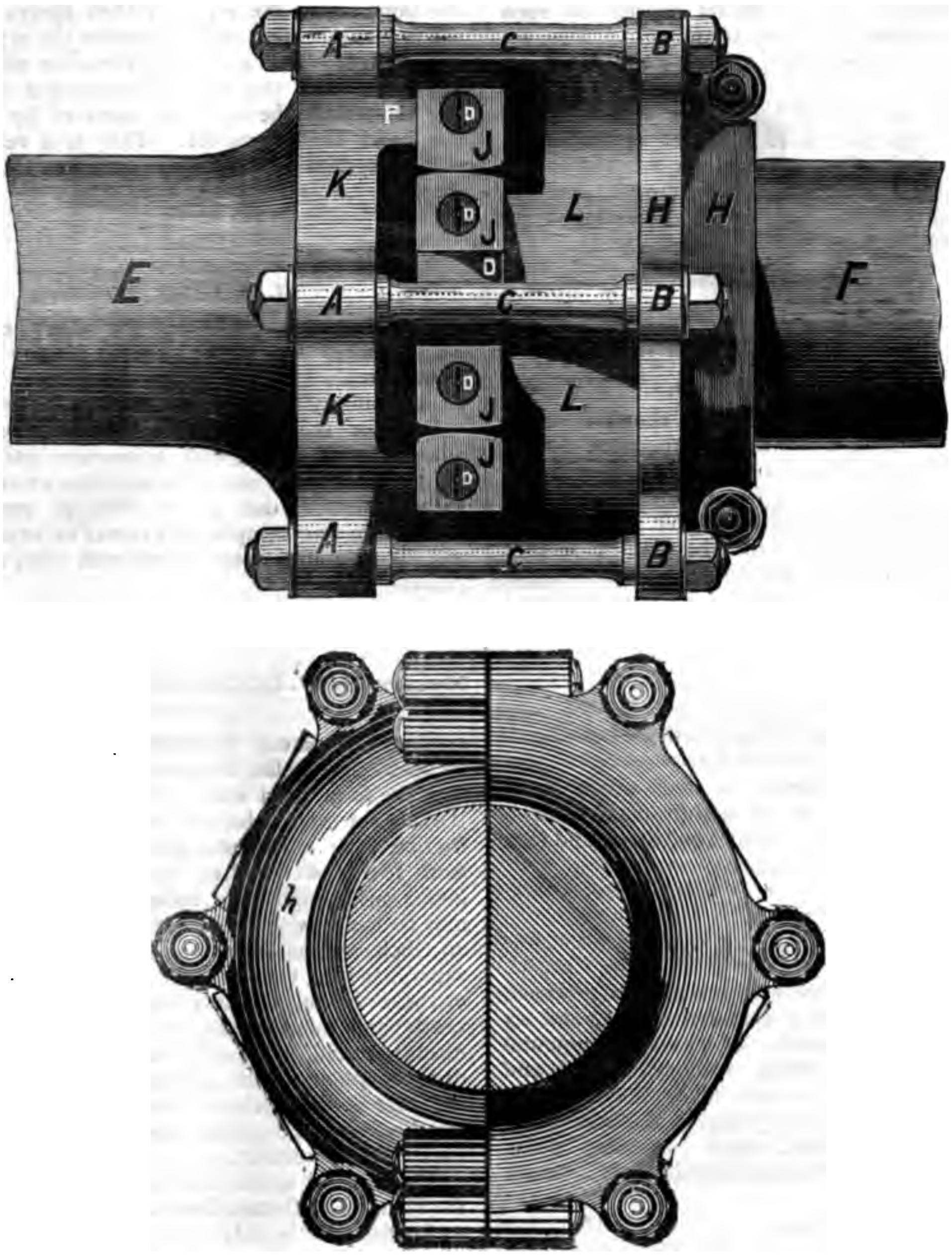
exhibited a 20-horse power (nominal), compound surface condensing screw engine, with a high pressure cylinder of 12½ in., and a low pressure cylinder of 22 in. The cylinders were inverted, standing upon condenser frames at the back, and turned wrought iron polished columns in front. The slot links are of the double bar pattern, with brass slide in valve spindle, the air pumps, circulating pump, bilge pump, and feed pump being attached between the crosshead, and worked by a pair of wrought iron beams. A small starting valve, double-posted, is fitted to the low pressure cylinder. All pins and joints case hardened, and all brasses wide, so as to give a large wearing surface. See illustrations pages 36 and 37.

Messrs. VOSPER & Co. Broad-street Portsmouth

exhibited a launch 22 ft. by 4 ft. 9 in., which was built of teak, fitted with one of their four cylinder engines. These engines are fitted so that two pairs of single-acting cylinders, set at an angle of 90 degrees with each other, drive the screw shaft.

These engines are noted for their compactness and the consequent limited space in which they will stow. In the launch shown it was, at first sight, difficult to discover the small but highly effective engine which was stowed very low down, nearly under the foremost stern-sheet thwart.

The efficiency and neatness combined in this engine has led to its adoption by many yacht and steam launch owners and builders.



PATENT FLEXIBLE COUPLING.

ARTHUR VERITY, of Leeds,

exhibited a Patent Flexible Coupling for ordinary shafts, whereby strained or bent shafting, or shafts at an angle to each other may be coupled together, and a rotary motion transmitted from one to the other. The two ends of the *E* and *F*, to be connected have cupped dies let into the centres of their respective shaft ends, to receive a ball which is inserted between them. This ball retains the axes of the end of each shaft an equal distance from its centre, without retarding or interfering with the motion thereof. In order to retain the ends of the shafts in contact with the ball, at the same time to allow of any eccentric or irregular movement thereof, flanges *K* and *L* are forged or cast solid on their respective shaft ends, with suitable projecting pieces or lugs, pand *O*, which are brought or actuated together in a similar manner to a toothed clutch.

The outer end of the flange *L* is made convex, concentric with the ball, and a concave plate *H* fitted thereon ; this plate is made in halves and fixed together by the bolts *M*. The ends of the shaft are held together by studs *C*, in combination with the lugs *A*, and flange *K*, and the lugs *B* on concave plate *H*, and owing to the peculiar formation of which the shafts *E* and *F* are held together, at the same time admitting of any irregular rotary movement of the shafts caused by such shafting being strained or placed at an angle.

The duplicate slips or friction plates *J* are fitted on the faces of the lugs *P* and *O* by set screws *D*. The slips adjusted on the lugs of the flange *K* and *L* are curved on their respective faces to correspond in such a manner as will admit of any eccentric or irregular movement thereof, at the same time to have the power which is transmitted through the shafts equally distributed on their repective faces.

Messrs. IHLEE & HORNE, 31, Aldermanbury, London,

exhibited Balmain's Luminous Paint, a chemical compound which absorbs light and diffuses the same during darkness. A life buoy, fishing net, mooring buoy, and a figure head for a ship were exhibited, painted with the above. The luminous paint is invaluable for buoys in channels, as when painted with this they can be seen at night as well as by day; for life buoys, it renders them visible to the drowning mariner when thrown overboard at night.

Messrs. HALSEY & CO., Wandsworth, and 82, Mark Lane, London,

exhibited at the main entrance a steel single screw steam launch, 55 ft. by 7 ft., as a third-class torpedo boat; also some very taking patent two, three, and four cylinder launch or yacht engines.

Messrs. A. WILSON & CO.,

exhibited two surface condensing screw engines arranged for a twin screw boat, with cylinders 8, 11, and 14 in. diameter, by 9 in. stroke; one patent compound surface condensing screw engine with cylinders 6 and 12 in. diameter, by 7 in. stroke; high pressure screw engines, circulating pump, air pump, and many other specialities of great interest, which we must defer, together with other marine engine exhibits, till a future issue.

Messrs. CHADBURN & SON, Liverpool and London,

exhibited a patent reply telegraph, which is very ingeniously contrived for either acting as a reply or for sending orders in detail. Electricity was a favourite system applied to vessels of all kinds for a short time, but on account of the want of constant batteries, and their frequently getting out of order at sea, this system was doomed to abolishment. The system of telegraphing adopted by Messrs. Chadburn and Son is called the "Endless band" system, the means of communication being by copper chain and galvanised wire, the instrument having wheels to which the chains are attached. The commanding officer moving his handle to any order, actuates the indicator in the engine-room causing a spring ball to strike a powerful gong at the same time; the engineer then moves his handle to the order indicated, which actuates the reply pointer on the bridge. The action is the same with the steering apparatus, with the one difference that the reply steering pointer on the bridge is actuated by the motion of the head of the rudder. This is a very simple and reliable system of telegraphic communication on board ship.

J. H. KIDD, Wrexham,

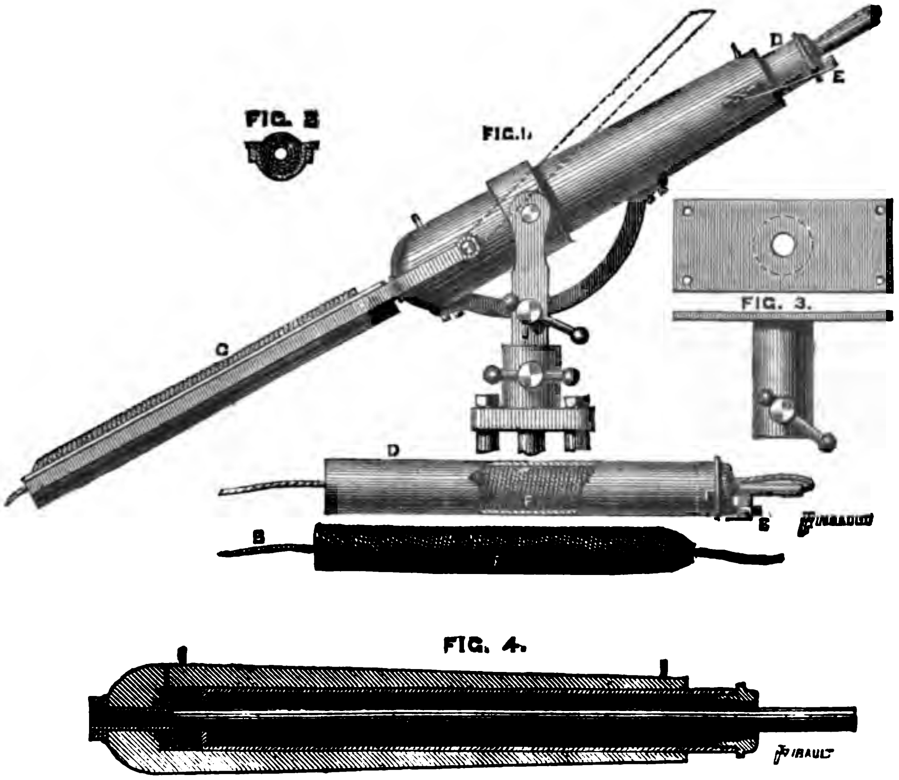
exhibited a water elevator or ship's emergency or ballast pump for raising liquids of any kind in the most simple and inexpensive manner. It consists of a plain cylinder, fitted with inlet and discharge valves for the water; an equilibrium valve for the admission of steam, and a vacuum valve for breaking the vacuum to allow the water to enter the cylinder with a velocity due to its head of pressure. This elevator has no complicated valves or wearing parts. It will lift or pump water mixed with clay, mud, sand or gravel.

Messrs. R. W. COUSENS & Co. Gt. St. Helens, London,

exhibited a patent "socket distress signal" for use on board ships in lieu of guns or rockets. This new signal is in the form of a small cylinder, and when placed in the socket from which it is to be fired by means of a friction tube is instantaneously propelled to a height of from five to six hundred feet. At this height it bursts, giving out a bright light, followed by a loud report which may be heard within a radius of 13 miles. The want of an efficient signal for use on board vessels as a distress signal has long been felt, the old methods of firing a gun or rocket having the drawback that with the gun it is costly and cumbersome, and frequently useless when most required, while the sound travels but a short distance under certain atmospheric conditions, whilst in the case of the rocket it is useless by day and in foggy weather gives no sound, and is unlikely to be noticed even in clear weather.

The "patent socket distress signal," manufactured by the Faversham Cotton Powder Company, is fired from a socket fixed in the side of any vessel or boat. The shell containing the signal and firing charge is dropped into this socket, and by horizontally pulling a lanyard attached to a friction tube at the top of the shell the charge is fired without light or fire of any kind being required.

Messrs. R. W. Cousens and Co. also exhibited a patent metallic valve by Kinghom and Co. This valve is made of elastic metal much more durable and efficient than indiarubber, and considerably less in first cost. The valves are in no way affected by hot water or engine oils. In substituting metallic for indiarubber valves it is necessary to fit cylindrical-shaped guards without any flat bearing or irregularity. The rods, studs, grids and seatings remain unaltered. These valves are extensively used by the Admiralty and most foreign Governments, and by all the principal British and Continental Steamship Companies and Engineering firms



EVANS & SON'S APPARATUS FOR PROJECTING LIFE LINES.

Messrs. EVANS & SON, of Dundee,

Exhibited their lately patented apparatus for projecting a life line from a stranded ship to the shore, or *vice versa*.

This apparatus, which we illustrate in figs. 1, 2, 3 and 4, consists of a gun made of wrought iron or brass, about 2 ft. long, with a bore of 2½ in. diameter, which, when used from the shore, is mounted on a tripod stand, but when fired from a vessel in distress, is arranged to fit into sockets in her rails in any desired position.

The section given in fig. 4, so clearly illustrates the construction of the gun proper and its internal arrangements, that a very brief description of this ingenious invention will suffice.

The gun is a smooth bore, and differs only from an ordinary signal gun—for which it is also adapted—in having a small tube screwed to and passed through its breech end, and extending up the centre of the bore to some inches beyond the muzzle. Its projectile is a metal cylinder, somewhat smaller in diameter, and longer than the base of the gun, having its inner end solid and outer one closed by a cap with a bayonet joint. Within this metal cylinder is a cop of line about 250 yards long, so coiled as to have a hole in its centre from end to end, to allow it to pass over the central tube of the gun. For throwing a longer length of line than that contained within the metal cylinder, means are provided at the near end of the gun for supporting a semi-circular shaped trough, into which any number of cops of line may be successively laid ready for use as required.

To load the gun, an annular-shaped cartridge of powder (about 2 ozs. in weight) and millboard wads are first passed down the barrel of the gun, and rammed home with a hollow ramrod. A cop of line, one of its ends having been first rove *through* the central tube of the gun and passed out at its breech end, is then put into the metal case, which, in turn, is passed down the bore of the gun *over* the central tube, until it rests on the wads which keep the cartridge in place. The line at the muzzle end of the cop is then attached to the bayonet-jointed cap of the metal case, and the cap locked, when the gun is ready for firing.

When used at night, a fuse attached to the cap of the metal case is fired by friction on the discharge of the gun, and keeps burning during the flight of the projectile, as an indication of its direction to those on shore.

Figure 1 in our illustration of this gun, shews it in position ready for firing. Some very satisfactory experiments were made with it some few weeks ago, when the range attained with a charge of 1½ ounces of powder was 340 yards.

The PATENT DIAGONAL ROCKING FIRE BAR CO., Palmer's Buildings, London,

exhibited patent fire bars, having the ordinary deep web, but with diagonally formed ribs projecting from the sides, and so arranged that the ribs of one are opposite the spaces of its neighbour. The webs engage in suitable notches formed in a cross bar underneath, which is moved horizontally from side to side by means of a pinion on which one end of the cross bar rests. The pinion is mounted on a shaft which is actuated by a hand lever or automatic arrangement. The other end of the cross bar is carried by a roller also mounted on a shaft. These fire bars ensure a constant supply of air through the serrations and teeth which no other fire bar has yet done. A most perfect combustion is thus kept up, and a great saving of fuel effected. These bars are now in use in the furnaces at South Kensington.

MESSRS. PIGGOT BROS., 59, Bishopsgate, Without,

exhibited a large and fine assortment of hammocks, cots, ships' furniture, English and foreign flags, tarpaulins, hatchway covers and improved water-proof sheets; also a large assortment of water-proof clothing, sou-westers, &c. The varied and useful nature of their exhibits as affecting the comfort of our naval officers and seamen could not be too highly appreciated.

The INDESTRUCTIBLE PAINT CO., LIMITED,

exhibited samples of the patent indestructible paint, patent enamel paint, and patent stone solution. The patent indestructible paint resists the action of all alkalies and acids; for iron structures, roofing, and all kinds of ship work where ordinary paint is useless it is invaluable.

The patent enamel paint can be prepared to dry either with an enamel surface, glossy and firm as porcelain, or flat if desired, and entirely free from the gritty and "sand paper" feel of ordinary "flat" paint. It resists any action of water, and is of the greatest use for keeping bunks, berths, and cabins clear of vermin.

The patent enamel solution is colourless; it is used for the preservation of stone, brick, cement and wood work from the effects of weather and damp. It leaves no deposit on the surface, and does not in any way alter the appearance of the coarsest stone. The softest stone, even chalk, is rendered by it thoroughly and lastingly waterproof. These paints are supplied ready mixed, and can be applied by an ordinary labourer.

MESSRS. A. HAACKE & CO., Lime Street Chambers,

exhibited specimens of raw, washed, calcined, and pulverized fossil meal. W. Berkfield's fossil meal composition as a non-conducting material for covering steam boilers, pipes, cylinders, &c., to prevent the radiation and loss of heat, as shown on a vertical boiler with a thermometer on the non-conducting covering, and one on the boiler plate, where the covering was cut away for that purpose, proved it the most effective non-radiating compound yet invented. Fossil meal isolating tubes for covering cold water and refrigerating pipes, also vibrating steam pipes to steam hammers, &c.

Fossil meal polishing paste for silver, electro-plate and other metals. The burnishing properties of this compound fairly astonished the occupants of other stands, who obtained some to brighten up the metal work of their exhibits.

Messrs. G. McLELLAN, of Glasgow and London.

had a fine stand at No. 318 of their well-known India-rubber goods for fire and deck hose, suction hose, corrugated treads for stairs and saloons, matting, squeeges, special suction pipe for use in raising vessels and recovering salvage, special oil-resisting valves for marine and land engines, for circulating, bilge, and all other pumps, steam and hydraulic packings, millboard for steam joints, steam hose, boiler joints, &c.

Messrs. STEWART & Co., LIMITED, 124, Newgate Street,

amongst other exhibits, showed Howe's patent spring berth bottom, sofa lounge, and deck-seat spring-bottoms. These are made of wood battens strengthened by wire rods. They are so strong that a person may stand their whole weight on the centre of one of a number of battens forming a berth or cot bottom. By using these in ordinary berths the danger of wet and damp is avoided, as the battens are some inches above the deal bottom of the berth. The elasticity or spring of these mattresses is as good as that of any copper or steel spring or stuffed mattress, whilst all danger of wear and tear from pressure on the ends of springs is entirely removed. The spring berth bottoms are largely used in the United States river steamers, the principal Atlantic steam ship lines, and amongst yacht owners.

W. BOAZ, Limehouse,

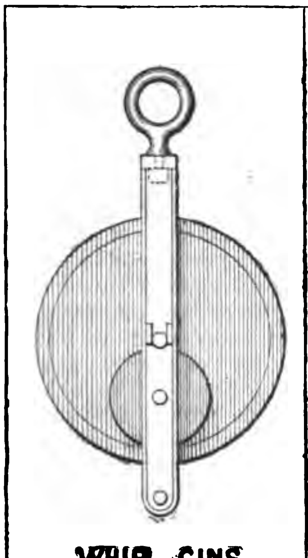
had a good display of his well-known Boiler Tube Stoppers, which for the sake of those not conversant with it, may be briefly described, as consisting of a male and female tube, of a length slightly larger than the boiler tube to be stopped; towards either end are two washers of a diameter slightly less than the inside of the tube, and with patent prepared rubber washers between; on the smoke box end of the stopper is a square shank, which when rotated through a slight angle brings each pair of washers together and squeezes the rubbers tight up to the inside of the tube; it will be noticed that the greater the pressure of the water on the washers the tighter the joint becomes; this we verified by testing one to 140 lbs. per square inch.

This instrument has been supplied to a very large number of shipowners, railway companies and private firms, all of whom give excellent accounts of its simplicity and effectiveness.

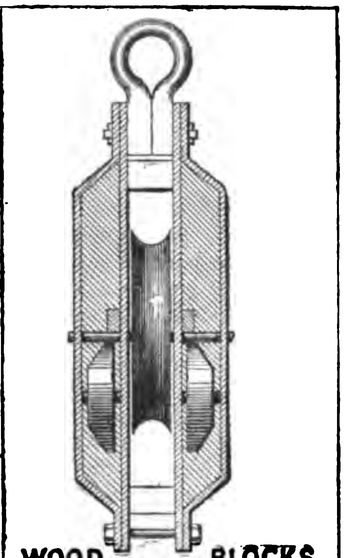
THE PATENT JOINTING MANUFACTURING CO., LIMITED,

of 17, Charterhouse Buildings, Goswell Road,

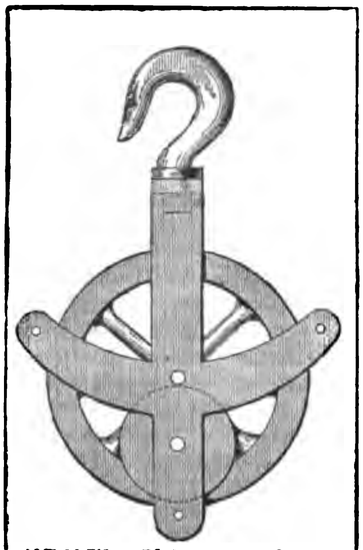
exhibit a patent jointing for steam water or gas pipes, the most reliable of any material now in use; a joint once made will never break unless broken intentionally, in which case the surface of the metal is easily cleared of all particles of the old joint. No waste, cutting, fitting, or fixing is required with this compound, as it is supplied ready for immediate use.



WHIP GINS



WOOD BLOCKS



HEAVY CARGO GINS

BREWER'S PATENT SHIP AND CARGO BLOCKS.

There is no part or tackle of a vessel that has more effect upon the daily easy working of the ship than the blocks or guide pulleys. Nor whilst in dock has anything more influence upon the speedy unloading and refreighting of the ship than the hoisting tackle. Wherever running ropes or chains are used, there pulleys are necessary, and there is a far larger proportion of power wasted by the stiffness and great frictional resistance of the ordinary pulley tackle than is at all imagined. The ordinary seaman is so accustomed to the defects of his customary tackle that he ceases to feel its defects until he is brought face to face with an obvious improvement.

When, however, that is the case, he is astounded that he did not notice the defects of usual methods before.

This was most startlingly evidenced by the open-mouthed admiration with which practical seamen examined the action of Brewer's Patent Blocks exhibited at the Submarine Exhibition by H. W. Carey, of 9, London Street. The blocks in question, some forms of which we illustrate herewith, are specially designed to rotate without frictional resistance by means of what are termed "lever" or anti-frictional wheels. The main pulley, instead of running on an axle in the ordinary bearings, rests on the periphery of two smaller wheels which run loose on their axles, the axles being carried in the side frames, and lubricated in a special manner. The result of this arrangement is that, as the main pulley only rolls on the bearing wheels, it travels almost frictionless, and when spun round will continue to rotate for a very long time. One figure shows a heavy cargo gin, with a wrought iron frame; another shows a wooden block, and the third a guide block.

To such an extent does the absence of frictional resistance in these blocks reduce the labour of hoisting, that it is found that three men can do what before was the work of five.

These blocks are now being largely adopted by the best classes of steamers, and also in the docks. When the importance of easy running tackle to short-handed vessels is considered, we do not consider any vessel should be considered up to the standard of efficiency unless fitted with these guide blocks.

FORRESTT & SON

Had a set of high speed compound surface-condensing engines, which was shown on account of their special design for lightness combined with strength—all working parts being made of steel, and bearings of Phosphor Bronze.

The condenser is oι course supplied with a centrifugal pump, and driven by a separate engine. Sizes of the cylinders were, 12½ and 20¾ by 12 in. stroke ; working pressure, 130 lbs.

A small carvel-built mahogany steam dinghy, 20 ft. by 5 ft. by 2 ft. 6 in. was also shown, with a little 3½ by 4 in. h. p. engine, by Percy, of Dover. We understand this class of boat is largely supplied to Torpedo boats, yachts, &c.

There were two models, one of a small steamer, 160 by 24 by 12 ft., being built for Thomson & Co., Mark Lane; the other of a composite yacht, 130 ft. over all, 80 ft. on water line, 18 ft. 2 in. beam, and 12 ft. deep.

Clifford's boat-lowering apparatus was also shown, and which we hear still holds its own amongst naval officers.

Messrs. Forrestt & Son are also makers of steam launches (drawings of which were shown) built in sections, which are specially designed for travelling in Central Africa. They have been supplied to Mr. Stanley, the well-known explorer, and to Colonel Stranch of the Belgian Government. One is also being constructed for the London Missionary Society.

Mr. W. G. SNOULTON, 96, High Street, Poplar,

exhibited a life raft that should be noticed. It is called the Crescent Life Raft, constructed of two semi-elliptical hollow pontoons, having their ends united at the bottom by hinges, so that their sides may be laid together when required for stowage; and when slung ready for use the ends will open on each side of the hinges, and be brought together and locked when the raft comes in contact with the water. On each pontoon there is secured a platform, and when the halves are brought together and secured by bolts, which are self-acting, an elliptical decked raft is formed, the deck of which is protected by the sides of the pontoons extending above or below it. This deck is intended to be composed of woven wire or rope netting, but it may also be made of canvas or wood. In order to facilitate the motion of the raft through the water its ends are hollowed, and the ends of the raft on the upper side are raised in order to give it a tendency to open out when unslung. The entire structure is built in water-tight compartments. The raft has been highly approved by the Board of Trade, and by many nautical men of experience, and was awarded the gold medal at the International Exhibition in 1873.

THE INTERNATIONAL MACHINE COMPANY

Exhibited some useful Engineers' Tools, also a new patented Steel Cartridge Shell for use by sportsmen, colonists, etc., and also adapted for use in rifles and punt guns. This latter, a simple gas-tight cartridge case, consists of a steel tube—*AA*, into which the required charge of powder and shot, with the wads, is rammed in the usual manner. It is constructed to take the ordinary wads and caps used with paper cases of corresponding gauge, and thus relieves the gun from the strain caused by using wads a size larger than the bore, as is necessary with most metal cases. The front end of the tube *A* being roughened inside, secures the top wad on shot as firmly as the turnover in the paper cases. At the base *B* will be found an annuler recess *e*, into which the cap is pressed, care being taken that it is perfectly flush with, or a little under, the surface of the base, to prevent the possibility of its firing in closing the breech of the gun. When fired, the cap is forced out by means of a sliding or piston anvil—*D*, which, on being pushed up by inserting a piece of stick or short rammer inside the shell, causes the exploded cap to drop out, thus dispensing with the use of any apparatus whatever, either for re-capping or re-loading.

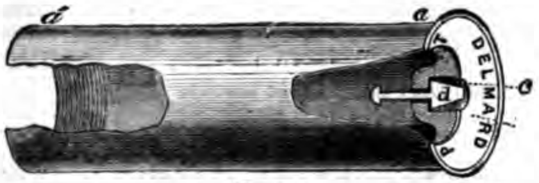


FIG. 1.

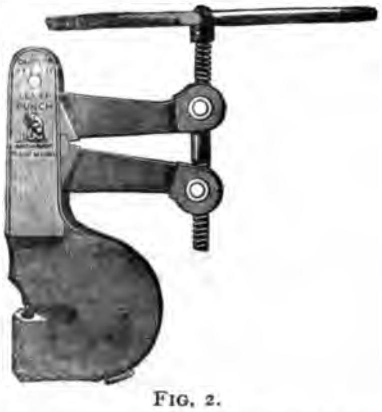
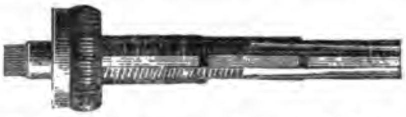


FIG. 2.

Figure 2 illustrates a Duplex Lever Punching Bear, in which this Company have effected a considerable improvement. The action of these bears is derived from a right and left-handed screw, which is passed through nuts held in the outer ends of the levers. The inner end of one of these levers is made with a solid pin on each side, one of these pins is held in its place at the top of the slot in the body by two small steel plates, and a recess is formed in which the pin takes a bearing.

The other pin works in a corresponding recess in the female lever, and a steel link at each side is fitted, so as to connect the male lever to the plunger, which has also a solid pin like the lever. The plunger holds the punch, and by turning the screw so as to bring the outer ends of levers together, forces the punch through the die. Great power is obtained by the leverage and screw, and enables a short wrench to be used, which is undoubtedly a great convenience, especially to men working in a confined space or on a scaffold.

Another useful tool this Company exhibits, is an Expanding Lathe Mandril, which is designed for turning rings, nuts, etc., of varying sizes, without the cost and time usually spent in turning up mandrils for each size required. A steel bar is turned taper about one-half its length, and a screw cut on the remainder. Keyways are then cut in the bar parallel to the taper part of the mandril, in which small keys are fitted to slide up and down. These keys are turned in steps, the steps being parallel to the axis of the bar. A nut is made with a recessed collar, which takes the ends of the keys, and as the nut is screwed up or down the screwed part of the mandril, so the keys expand on the reverse as they move up or down the slots.



We are compelled to hold over, for want of space, the descriptions and illustrations of many exhibits.

THE Tyne Commissioners have contracted with Messrs. Hepple and Co., of South Shields, for the building of an iron steam ferry-boat to cross on the Tyne from North to South Shields. The Commissioners have also contracted with other builders for two wooden hoppers at a cost of £4,450, and they further propose to build two more large hoppers at their yard at Howden.

ENGINE builders from the Tyne to the Tees have all a considerable number of orders on their books. Large extensions of works have been made at Stockton and West Hartlepool. At Messrs. T. Richardsons and Son's Middleton works the production has been increased fully one-third by extension.

* OCEAN STEAMSHIP MACHINERY.

A SERIES OF PRACTICAL PAPERS ON THE DESIGN, CONSTRUCTION, AND MANAGEMENT OF THE MACHINERY OF STEAMSHIPS.

By H. Holt-Butterfill, Marine Engineer.

Continued from page 11.

II.—The Problem of Ocean Steamship Design.

IN addition to the primary qualities of buoyancy, stability, and speed, which naturally pertain to all vessels—whether steam or sailing—intended to navigate the sea with safety, there are others necessary to steam propelled ships which are not looked for in vessels whose means of movement is dependent upon the wind.

Not only at sea, but especially when in close waters and rivers, is it necessary that a steamship should possess the quality of being easily worked or handled; that is to say she should not only be able to answer her helm quickly and with certainty, but at the same time should, when required, have the power of speedily arresting her motion through the water, and, if the necessity arises, of reversing it also.

It is not, of course, possible that any ship should possess all the qualities above enumerated in a maximum degree, as they to some extent neutralise each other; but in the endeavour to provide such of them as are the more important in each particular case, the naval architect shows his skill in so proportioning these that they may not unduly impair the others. To this end he works in accordance with certain known *principles* upon which these several qualities depend. Taking these qualities in the order before given, the principles affecting them are as follows: and, first, as to the

Buoyancy of a Ship. We say that a body is *buoyant* that will not sink in a fluid, but remains, if the fluid be at rest—steadily floating on its surface in a given position. This pre-supposes that the "body" is a *solid* substance, or one whose material elements or particles are so dense or compacted together as to resist the effort of other bodies to alter its shape; and that the "fluid" is the converse of this, or a mass whose particles yield to the least effort made to move or change their relative positions without separation.

Now, this condition of *flotation* of the solid body in a fluid at rest can only obtain when the weight of the solid body is less than its *volume* of the fluid. This requirement being fulfilled, the floating body on being immersed in the fluid will sink into it until the weight of the water displaced is equal to the weight of the body immersed. When these two weights are equal the body will remain in *equilibrio*, or at rest.

To bring about this condition, the opposite action of two systems of forces has been called into play. One is the vertical action of gravity on the particles of the floating body, pressing it downwards, and the other the upward vertical pressure of the fluid; and as these forces are parallel and opposite to each other, and their opposite action keeps the body in *equilibrio*, they are necessarily equal in amount. From this reasoning it follows that in order that such a body as a ship may float steadily in smooth water the weight of the volume of water displaced by her must be equal to her weight. This *volume* is called, as is also its *weight*, the "DISPLACEMENT." The truth of the foregoing reasoning may be easily verified by experiment with apparatus within the reach of every student.

(*To be continued.*)

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* The Author reserves the right of re-publication and translation of these papers.

Review.

Reed's Engineer's Hand Book.

This useful work, although termed a Hand Book, is a good-sized volume full of valuable examples and information which should be carefully considered by all students of marine engineering. This work is a valuable help to competitors to the Local Marine Board examinations for certificates of competency as first and second class engineers, by W. H. Thorn, with a supplement containing the answers to the elementary questions.

Part 1 deals with the arithmetical knowledge and examples to be worked up to by all students preparing themselves for the marine engineering profession, from the first four rules of arithmetic to evolution, cube root, mensuration, and specific gravities of bodies.

Part 2 contains the answers to the questions in Part 1 which, if all thoroughly worked out correctly, would form a good groundwork for those wishing to prepare themselves for higher branches of practical and theoretical marine engineering knowledge.

Part 3 deals with the arithmetical problems of the marine engine, including the use of arithmetical signs, the solving of various useful formulæ, weights and prices of different parts of machines, horse-powers, consumption of fuel, rate and slip of screw, strength of boilers, factors of safety, strains on bars, shafting and beams, either torsion, bending, or transverse, with examples of examinations in these subjects for first and second class engineers.

Part 4 contains explanations and ezamples of everything appertaining to the marine engine. The uses and applications of the barometer, thermometer, hydrometer, salinometer, fuel and heat, management of engines and boilers, tables of diameters and stroke of compound engines, breaking and crushing strains, different modes of rivetting, and much other useful information and examples may be found in this section. The information contained in this part will be found not only useful to elementary students, but also a compilation of useful facts and theories of great value to marine engineers generally.

The diagrams in the supplement are drawings given as an example of what have been proposed at the Board of Trade examinations. They are not intended to illustrate any particular maker's style, but are given so that candidates can see what style of drawing is required from them. The examiners do not want strict adherence to the particular scale given; the drawings may be roughly made to scale, but all dimensions must be correctly marked in figures.

THE two shafts for the beam-engines of the *Pilgrim*, the huge steamboat now building at Roach's shipyards in Chester, Pa., for the Old Colony Steamboat Company, will be the largest ever forged. One of them is ready to be turned and finished, and the other is in the forge. The iron used is made up of scraps of boiler plates, nuts and screws, and horse-shoes. These are first run together into bars, two feet or more in length. The shaft is built by adding from four to six of these bars at a time to the end, welding them on in the furnace, and beating them into shape with the powerful steam-hammer. Then more are piled about the end of the shaft at a white heat, and welded on in the same way. The two shafts now making measure 40 ft. long each, with a diameter varying from 27 to 30 in. They weigh over 81,000 lbs. The shaft of the steamship *City of Rome* is perhaps as large an example of shaft forging as now exists. It is of steel, and but 22 ft. long and 26 in. in diameter, with a 10-in. hole through the centre. The shaft for the *Pilgrim* already done was forged in thirteen days and seven hours.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Leicester Castle.—On March 25th Messrs. Oswald, Mordaunt & Co., launched from their shipbuilding and engineering works, Southampton, an iron ship of 2,000 tons register, named the *Leicester Castle*, built to the order of John Coupland, Esq., Goscote Hall, Leicester. The ship's dimensions are:—Length, 270 ft.; breadth, 39 ft. 6 in.; depth of hold, 24 ft. The *Leicester Castle* is a sister ship to the *Victoria Regina*, built in December last, and is fitted with full poop, monkey forecastle, and large midship house for crew. She is fitted with Harfield's patent windlass for lifting anchors, and all the latest improvements. The ship is intended to class 100 A 1 at Lloyd's, and 20 years in the Liverpool Underwriters' Registry. During the course of construction the vessel has been inspected by Mr. Malcolm and Captain Boaz.

Earl of Dumfries.—On March 29th there was launched from the shipbuilding yard of Messrs. Elliot & Jeffery, at the West Bute Docks, Cardiff, a new iron paddle steamer tug-boat, named the *Earl of Dumfries*, which makes the fifth vessel they have built for towing in the Bristol Channel. The following are the dimensions of the steamer:—Length over all, 90 ft.; beam, 17 ft. 6 in.; and depth, 9ft. 4in. She is fitted with side lever and condensing engine, which works up to 240-horse power. All the bearings are of phosphor bronze, and all pins, shafting, and journals of steel. The paddle wheels have patent feathering floats. The vessel has also a patent donkey engine for supplying the boilers with water, pumping out bilges, and washing decks. Steam is supplied from a pair of flue boilers of strong construction. The ceremony of christening the boat was performed by Mrs. John Slight Jeffery, the wife of one of the partners.

Essex.—On April 4th there was launched from the yard of Messrs. Raylton, Dixon, & Co., Cleveland Dockyard, Middlesborough, an iron screw steamer, built to the order of Messrs. Money Wigram & Son (Limited), of London, for their Australian line of steamers. Her principal dimensions are:—Length over all, 310 ft.; breadth, 40 ft.; depth of hold, 25 ft. 3in.; and she will have a deadweight capacity of about 3,700 tons. She is built on the three-deck rule, has iron main deck and upper laid with teak. Poop aft for the captain and officers, accommodating bridge amidships, topgallant forcastle, &c., and will be fitted with engines of 250-horse power, by Messrs. T. Richardson & Son, of Hartlepool. On leaving the way she was christened the *Essex*, by Miss Edith Cochrane.

Invicta.—On April 5th a new paddle steamer, named the *Invicta*, was launched from the yard of the Thames Iron Works and Shipbuilding Company, at Blackwall, with engines by Messrs. Maudslay, Son, & Field. The *Invicta* will run in the Channel service between Dover and Calais in connection with the mail trains of the London, Chatham, & Dover Railway, and is expected to perform the sea passage in one hour.

Beechville.—On April 5th William Gray & Co. launched from their yard, at West Hartlepool, an iron screw steamer of the following dimensions:—Length, 257 ft. 6 in. by 35 ft. 6 in. by 19 ft.; classed 100 A 1 at Lloyd's; built to the order of Messrs. R. Shadford & Co., Sunderland. She is intended for the Indian and general trade, to carry about 2,400 tons; and is fitted with all recent improvements, including steam steering gear amidships, and patent gear aft, patent Windlass by Emerson & Walker, and four steam winches by Clark, Chapman, & Gurney. The engines, which are 150-horse power, are supplied by Messrs. Blair & Co., Stockton-on-Tees. The vessel is to be commanded by Captain Thomas Watson, of Hartlepool, under whose superintendence she has been built. On leaving the ways the christening ceremony was performed by Mrs. Pinder. of Hartlepool, the vessel being named *Beechville.*

Tana.—On April 6th there was launched by Messrs. S. P. Austin and Son, Wear Dockyard, Sunderland, an iron screw steamer. She has been built to the order of Messrs. Chas. Salveson and Co., of Leith, under the superintendence of Mr. David Marshall, and is of the following dimensions:—233 ft. length over all; 32 ft. extreme breadth; 16 ft. 6 in. depth of hold; gross tonnage about 1,100, nett tonnage about 700. She is constructed with long break, short full poop, bridge house, topgallant forecastle, and iron decks. She will be fitted with compound surface condensing engines by Messrs. Blair and Co., Limited, of 120-horse power nominal; Napier's patent steam windlass; three steam winches by Clark, Chapman, and Gurney, and all the latest improvements. As she left the ways the vessel was named the *Tana*, by Miss R. J. Wilson, of Sunderland.

Flora.—On April 15th there was launched from the yard of Earle's Shipbuilding Company at Hull a steamship built for Mr. William Bailey, J.P., and intended for his firm's Hamburg trade. As the vessel left the ways she was named by Miss E. Rollit the *Flora*. The *Flora*, which will be a schooner-rigged vessel, has accommodation for 30 first-class passengers in the saloon, and for 20 second-class passengers. She is 250 ft. long, 32 ft. broad, and 16½ ft. deep; gross tonnage, 1,300 tons. Her engines will be 200-horse power nominal, the cylinders being 34 in. and 64 in. in diameter, with a 9-in. stroke. The working pressure of her boilers will be 85 lbs. Their diameters are 15 ft. 3 in., and their length 10 ft. 4 in. The engines and boilers are being constructed at Messrs. Bailey and Leetham's Humber Iron Works.

Everilda.—On April 17th Messrs. Turnbull and Son launched from the Whitehall Shipbuilding-yard, Whitby, an iron screw steamer of the following dimensions:—Length, 240 ft.: breadth, 34 ft.; depth of hold, 17 ft. 9 in., with a carrying capacity of about 1,950 tons. Her engines, of 130-horse power, are by Richardson and Sons, of Hartlepool. The vessel is built to the order of Messrs. Turnbull Bros., Cardiff, and is intended for the Black Sea and American trades. She was christened the *Everilda* by Mrs. H. C. Walker.

Wendouree.—On April 18th Messrs. S. and H. Morton, Shipbuilders, Leith, launched from their yard a screw steamer of the following dimensions:—Length, 274 ft.; breadth, 36 ft.; depth, 22.9 ft. She has been built to the order of Messrs. Huddart, Parker, and Co., of Melbourne, for the Australian trade. The vessel is constructed entirely of steel, and is of the highest class at Lloyd's. Her gross tonnage is about 1,700 tons, and carrying capacity 2,500 tons, and the engines, of 250 horse power, will be capable of driving the vessel, when loaded, at a speed of 11 knots. As the vessel left the ways she was named the *Wendouree* by Mrs. Parker.

Thor.—On April 19th Messrs. M. Pearse and Co. launched from their shipbuilding-yard at Stockton an iron screw steamer of the following dimensions, viz.:—Length, 255 ft.; breadth, 35 ft.; depth, 18 ft.; about 1,550 tons gross register, and classed 100 A 1 at Lloyd's. Her engines will be 140-horse power nominal, by Messrs. Blair and Co. As she left the ways the name of *Thor* was given to her by Mrs. Kay, wife of the managing owner. This is the seventh steamer Messrs. M. Pearse and Co. have built for Richard J. Kay, Esq., of Birtley.

Rougemont.—On April 19th Messrs. Edward Finch & Co. (Limited), of Chepstow, launched from their engineering and shipbuilding yard, an iron screw-steamer, built to the order of Messrs. John Cory & Sons, of Cardiff. Her principal dimensions are:—Length 250 ft.; breadth, 35 ft.; depth of hold, 18 ft. 3 in., with a deadweight carrying capacity of 2,000 tons. She has a long raised quarter-deck, bridge-house, and topgallant forecastle for crew, and double bottom in fore and aft holds for water ballast, containing about 250 tons of water. The decks are of iron. She will be fitted with three powerful steam winches and donkey boiler; Emerson & Walker's patent windlass; Chadburn's patent telegraph; patent steering gear and other latest improvements. She will be rigged as a two-masted topsail schooner, and has been built under Lloyd's special survey for the highest class, and under the superintendence of Captain Tyke for the owners. The engines, which are to be compound surface-condensing of 130 nominal horse power, with two large boilers for a working pressure of 80 lbs per square in., are to be fitted by the builders. As she left the ways she was christened *Rougemont*, by Miss Rowe, daughter of the managing director.

Remembrance.—On April 19th, Messrs. Short Brothers, Pallion, Sunderland, launched the screw-steamer *Remembrance*, built by this firm to the order of Messrs. Freead & Dix. The following are the dimensions:—Length over all, 280 ft.; extreme breadth, 36 ft.; depth of hold, 20 ft. 6 in.; deadweight cargo capacity about 2,500 tons. She has a long raised quarter-deck, extending to bridge, full topgallant forecastle, and short poop aft over cabin. Her classification is highest in Liverpool registry. She will be engined by the North-Eastern Marine Engineering Company (Limited) with a pair of surface-condensing engines of 160-horse power, and all the latest improvements. She has Harfield's patent windlass, Higginson's steam steering gear, four steam winches from Messrs Crawford & Sons, Bonner's Field Engine Works, Monkwearmouth. As the vessel left the ways the duty of naming her was accomplished by Mrs. J. Freead.

LAUNCHES.—Scotch.

Heimdal.—On April 3rd, Messrs Dobie & Co. launched from the Govan shipbuilding-yard an iron screw-steamer, built in accordance with the highest classification of Lloyd's and Veritas, for the North Atlantic trade. This vessel measures about 2,000 tons gross, and has been constructed for the Steamship Freja Company, of Copenhagen, to the order of Messrs. Henderson & Co., engineers, Glasgow, who are themselves supplying the machinery. As she left the ways the vessel was named *Heimdal* by Miss Henderson, Hamilton Drive.

Werneth Hall.—On April 3rd, Messrs Charles Connell & Co. launched from their shipbuilding yard at Scotstoun, the *Werneth Hall*, a steel screw steamer of 4,250 tons, built to class 100 A 1 in Lloyd's registry, and with a considerable number of extras beyond their requirements for a steel vessel. As she left the ways she was immediately taken to Finneston Crane to get her machinery put on board, which Messrs. John and James Thomson, Finneston Engine Works, supply. The *Werneth Hall* has been built to the order of Messrs. Alexander & Radcliffe, Liverpool, for their Hall Line of steamers, trading between Liverpool and Bombay. Accommodation for a limited number of first-class passengers is provided. She is fitted with Sir William Thompson's compasses, Harrison's steam steering gear, Harfield's windlass, Chadburn's telegraphs, and everything necessary for a first-class steamer, and has unusual facilities provided for the rapid loading and discharging of cargo.

Mudela.—On April 4th, Messrs. Alex. Stephen & Sons launched an iron screw steamer of about 1,800 tons, built under special survey to the highest class at Lloyd's. This vessel is to the order of Senor Martinez de les Rivas Bilbao, and is specially designed and fitted for the Bilbao ore trade. Her engines, also by Messrs. Stephen, are on the most improved principle, and have cylinders 35 in. and 65 in. in diameter respectively, by 42 in. stroke, with boilers ample in size, and suitable for 80 lbs. pressure. She was named the *Mudela*, by the wife of Captain Selvidegoitia, who is to command the steamer.

Corinna.—On April 5th, Messrs. David & William Henderson & Co. launched from their shipbuilding-yard, Partick, a screw steamer of the following dimensions, viz.:—235 ft. by 32 by 22 ft., and 1,235 tons, which has been built to the order of H. R. Robson, Esq., for the Tasmanian Steam Navigation Company for their intercolonial passenger and cargo trades. The vessel is constructed in accordance with the highest class of the Liverpool Registry, having water ballast, steam stearing gear, steam windlass, and all other modern improvements. On leaving the ways she was named *Corinna* by Miss Robson, of Royal Crescent, W. The vessel was immediately thereafter placed under the crane at the dock of her builders, where she will receive her machinery, which is also supplied by them.

Port Glasgow.—On April 5th, Messrs. Russell & Co. launched from their Port Glasgow yard an iron barque named the *Port Glasgow*, of the following dimensions :—Length, 200 ft.; breadth of beam, 32 ft. 6 in.; depth of hold, 19 ft. 6 in.; of 900 tons. This is the first of a new line of vessels to be called the Port Line, for the new firm of Messrs. Crawford & Rowat, Glasgow, and the second of the line, to be named the *Port Gordon*, will at once follow to be also built by Messrs. Russell & Co. The *Port Glasgow* will be loaded in Glasgow by Messrs. Thomas Law & Co., for Wellington (N.Z.)

Gitana.—On April 6th there was launched from Messrs Ramage & Ferguson's shipbuilding-yard, Leith, an iron auxiliary screw steam yacht, named the *Gitana*, of 500 tons y.m., for Henry Jameson, Esq., Dublin. Her dimensions are :—Length over all, 178 ft.; beam, 26 ft.; depth, moulded, 16 ft. 6 in.; and the engines of 85 h.p.n., having cylinders 23 in. and 44 in. in diameter by 24 inches stroke, working at 75 lbs. pressure. The rig is that of a three-masted schooner.

Glanworth.—On April 6th there was launched from the shipbuilding-yard of Messrs. John Key & Sons, Kirkcaldy, a screw steamer of 850 tons gross, built to the order of the Australian Steam Navigation Company, Sydney (N.S.W.) The following are her dimensions:—Length, 210 ft.; breadth, 29 ft.; depth of hold to main deck 12 ft., and to awning deck 19 ft. The vessel has been built under special survey, and is classed A 1 at Lloyd's. She is fitted up with all the latest improvements for the passenger trade in the colonies, having accommodation in the saloon aft for 50 first-class passengers and 75 second-class forward. This steamer is sister ship to the *Ranelagh* (s), launched in December last from the same yard. On leaving the ways she was named the *Glanworth* by Captain Tronton, manager of the Australian Company. The vessel was immediately towed into the harbour, where she will be supplied by the builders with engines of 160 nominal horse-power of the latest construction, having cylinders 30 in. and 60 in. diameter respectively, with 29 in. stroke.

Katherine Clark.—On April 17th, Messrs. Robert Duncan & Co. launched at Port Glasgow an iron screw steamer of the following dimensions :—Length, 208 feet; breadth of beam, 29 ft.; depth of hold, 14 ft.; 800 tons. Messrs. Kincaid & Donald, Greenock, will supply the engines, of 100-horse power. The new steamer, which is named the *Katherine Clark*, is to be engaged in the Bilbao trade, and has been built to the order of Messrs. James Little & Co., Glasgow and Greenock, for Bailie James Clark, Paisley.

Maipo.—On April 19th, Messrs. John Reid & Co. launched at Port Glasgow a screw steamer of the following dimensions :—Length over all, 345 ft.; breadth of beam, 41 ft.; depth of hold, 28 ft.; and about 3,000 tons. The engines are to be supplied by Messrs. Rankin & Blackmore, Greenock. The new steamer, which is named the *Maipo*, has been built for the Campania Sud Americana de Vapores, Valparaiso, and is to trade on the West Coast of South America. She is to be in command of Captain Stewart. The *Maipo* is fitted up for the accommodation of passengers.

Firefly.—On April 19th, Messrs. T. B. Seath & Co. launched from their shipbuilding-yard at Rutherglen a small iron screw steamer, built to the order of Messrs. James Ewing & Co., India merchants, Glasgow, of the following dimensions :—63 ft. long, 14 ft. beam, and 7 ft. deep. As she left the ways the vessel was named the *Firefly* by Miss Harriet Wilson, Rutherglen. The machinery, which is of the most modern description, is supplied by Messrs. Campbell & Sons, Cheapside Engine Works, Glasgow.

Falls of Dee.—On April 20th, Messrs. Russell & Co., shipbuilders, Greenock, launched from their shipbuilding-yard a four-masted iron sailing ship of the following dimensions :—Length, 275 ft.; breadth, 41 ft.; depth, 23 ft. 9 in.; and of 1,900 tons registered. She is fitted up with all the latest improvements for facilitating the loading and discharging of cargo, and nothing has been neglected by her builders to make her complete in every respect for the East India trade. The vessel, which is owned by Messrs. Wright & Breakenridge, Glasgow, was, on leaving the ways, named the *Falls of Dee*, and is a sister ship to the *Falls of Afton*, recently launched and fitted out for sea by the same firm.

Omapere.—On April 20th, Messrs. Wm. Denny & Bros. launched from Leven Shipyard, Dumbarton, a steel screw steamer of about 590 tons gross register, for the Union Steamship Company, New Zealand. She was named the *Omapere* by Mrs. Orknay, wife of Captain Orknay, who will command the vessel. The dimensions of the *Omapere* are :—Length between perpendiculars, 180 ft.; breadth moulded, 29 feet; depth moulded, 15 ft. 3 in. She will be fitted by Messrs. Denny and Co. with a pair of compound surface-condensing engines, having cylinders 24 in. and 42 in. diameter, and stroke of piston 30 in. The *Omapere* is intended for the New Zealand coasting trade, and is built to the highest class at Lloyd's. Her construction has been personally superintended by Mr. John Darling, superintendent of the Union Steamship Company of New Zealand.

Clan Mackenzie.—On April 20th there was launched from Messrs. Ramage and Ferguson's shipbuilding-yard at Leith the steamship *Clan Mackenzie*, an iron screw steamer, built to the order of Messrs. Cayzer, Irvine and Co., of Glasgow and Liverpool, and intended for their Indian service. This steamer is the largest ever built at Leith, being 3,200 tons register, and having a deadweight carrying capacity of 4,000 tons. Her dimensions are :—Length over all, 345 ft.; breadth moulded, 40 ft.; depth moulded, 30 ft. to main deck; and she is built to the highest class at Lloyd's. A large poop aft contains accommodation for 50 first-class passengers, the officers and crew having their quarters under the midship bridge and topgallant forecastle. A complete cellular double bottom extending the whole length of the ship contains water ballast when required, and adds greatly to the vessel's safety, which, besides, is divided into eight water-tight compartments by bulkheads. The engines have cylinders 39 in. and 75 in. diameter by 48 in. stroke, the steam being supplied at a working pressure of 80 lbs. per square inch.

Tibor.—On April 21st, Messrs. Burrell & Son launched from the lower Woodyard, at Dumbarton, a screw steamship of about 1,500 tons gross register, built for the Adria-Hungarian Sea Navigation Company. As she was leaving the ways she was named the *Tibor* by Miss Bessie France, Braehead, Lenzie. The dimensions of the *Tibor* are as follows:—Length, 245 ft.; breadth, 35 ft.; depth, 17 ft. She will be fitted up with compound direct acting vertical inverted engines, of about 150-horse power, by Messrs. Matthew Paul and Co., engineers, Dumbarton; cylinders 50 in. and 55 in. diameter; stroke of piston, 36 in.

Clapet I.—On April 22nd, Messrs. Lobnitz and Co. launched from their shipbuilding and engineering works, Slip Dock, Renfrew, a large hopper barge destined for the works of the Panama Canal. The vessel is 135 ft. long, 25 ft. broad, and 11 ft. deep, and is fitted with compound surface condensing engines having cylinders 21 in. and 42 in. diameter, and 2 ft. stroke. She is intended to carry about 400 tons of dredged material at a speed of 7½ knots per hour. Messrs. Lobnitz and Co. are building eleven steam vessels for the works of the Panama Canal, of various kinds, such as dredgers, hopper-barges, tug-boats, and service-boats.

LAUNCH.—FRENCH.

Parana.—On March 19th the "Forges et Chantiers de la Mediterranee" successfully launched from their Graville Yard, near Havre, an iron screw steamer built for the "Chargeurs Reunis" Company of Havre, intended for passenger and cargo trade between Havre and the River Plate. The following are the principal dimensions of the vessel:—Length between perpendiculars 349 ft.; breadth moulded, 40 ft.; depth moulded, 32 ft.; gross tonnage, 3,300 tons. She is spar-decked with three iron decks, and built under the special survey to the first class in "Bureau Veritas" register. She is provided with two iron masts, five steam-winches, steam-windlass, Stapfer's patent stearing-gear, and all the modern improvements. The vessel will be fitted by the same firm with compound engines of 1,600 indicated horse-power. She will have comfortable accommodation for 40 first class and 900 steerage passengers. She was christened *Parana* by Miss Juanita Vignal, daughter of the director of the "Chargeurs Reunis" Company.

LAUNCH.—GERMAN.

Stern.—On April 26th there was launched from the Flensburg Iron shipbuilding yard, a steamer, built to the order of Messrs. Holm and Molzen, of Flensburg, and is of the following dimensions:—200 ft. by 28 ft. 8 in., by 15 ft. 1 in., engines compound, 80 nominal horse-power. She is especially built for carrying heavy cargoes, her decks being made of iron. As she left the ways she was christened the *Stern* by Miss Bertha Wilms. After launching she was taken to the sheer-legs to get her engines and boilers put in.

LAUNCH.—SWEDISH.

Arendahl.—On April 21st this steamer was launched from the yard of the Notala Company at Lindholmen, near Gothenburg. *Arendahl* is built for "Arendahls Dampskib Selskab" in Norway, is intended for the mail route between Kristiania and Bergen, and is of the following dimensions:—Length, 170 ft.; breadth moulded, 27 ft. 6 in.; depth of hold from top of keel, 12 ft. 10 in.; height between decks, 7 ft. 4 in. The engine, of 110 nominal horse-power, will immediately be shipped.

TRIAL TRIPS.

Minard Castle.—On March 25th the *Minard Castle* (*s*), which has been built by Messrs. Raylton, Dixon & Co., Middlesbrough, for the Castle Line of Messrs. T. Skinner & Co., proceeded on her trial trip. She is almost a sister ship of the *Bothwell Castle*, which was built by them for the same firm twelve months ago. The *Minard Castle* is 332 ft. over all, 38 ft. beam, and 26 ft. depth of hold, having rather finer lines than the sister vessel. She has a gross register of 2,550 tons, will carry 4,000 tons of tea as well as coals for her homeward voyage. Her decks are all of East India teak and there is a spacious deck-house aft, which contains the cabins. The engines are by Messrs. T. Richardson & Son, and will indicate 1,300-horse power, having cylinders of 40 and 75 in. in diameter and 42 stroke, with very large boiler power. She proceeded to sea having 1,200 tons dead weight on board, and a mean draught of 15 ft. 3in., and after adjusting compasses of the Tees, made a most successful speed trial, attaining the result of 13·6 knots per hour.

Boskenna Bay.—On March 28th the spar-decked screw steamer *Boskenna Bay*, built by Messrs. Schlesinger Davis & Co., of Wallsend, and engined by Messrs. R. & W. Hawthorn, of Newcastle, had a satisfactory trial trip. The vessel left the builders' yard in the morning and proceeded to sea, where, during several hours' trial, she registered a mean speed of 12 knots an hour, the engines working the whole of the time smoothly and well. The *Boskenna Bay's* principal measurements are as follows:—Length between stem and sternposts 290 ft., breath 37 ft., and depth moulded 28½ ft. She classes 100 A 1 at Lloyd's. Powerful steam winches, by Messrs. J. Smith & Sons, of Newcastle, are placed at the hatches, and Donkin & Nichol's steam steering gear is fitted in the wheel-house amidships. Harfield's steam windlass is fitted for working the anchors, and all necessary appliances for quick working and dispatch are supplied. The leading dimensions of the engines are:—Cylinders 37 and 70 in. in diameter, having a stroke of 45 in. to each. Boiler working pressure 80 lbs. Captain Sherris, of Scilly, has superintended the completion, and now takes command of the vessel.

The *Joseph Arbib* (*s*).—On March 31st the *Joseph Arbib* (*s*), which has been built by Messrs. Raylton Dixon & Co., of Middlesbrough, to the order of Messrs. C. & C. Arbib, of London, proceeded on her trial trip. She is of the following dimensions:—279 ft. length over all, breadth 35 ft., depth of hold 24 ft. 3 in. Her dead weight capacity is about 2,700 tons. She is built on the three-deck rule, with main deck of iron, water ballast in main and after holds, with poop aft for accommodation of officers and passengers, also a bridge with accommodation-houses underneath. She is fitted with steam stearing gear, and all the latest improvements in this class of vessel. Her engines of 170-horse power, are by Messrs. Richardson & Son, of Hartlepool, and showed a result on the log of 11 3-8th knots at the trial trip.

Polyphemus.—On March 31st, this armour-plated torpedo ram, 2,610 tons, 5,500-horse power, made a satisfactory speed trial at the measured mile off the Maplin Sands, averaging about 17·25 knots per hour, although the engines did not work up to their full power. The engines worked very satisfactorily, there not being the slightest sign of priming or hot bearings. The final full-speed trial will be made when the vessel is completed and ready for sea.

George Heaton.—On March 31st, the iron screw steamer *George Heaton*, which was launched a few weeks ago from the yard of the Wellington Quay Shipping Company proceeded on her trial trip from the Tyne, and gave much satisfaction. This steamer has been built to the order of Messrs. Charles Tully & Co., and is intended to form a further addition to Messrs. Tully's fleet, to run between the Tyne and Baltimore, to bring produce of America direct to the Tyne. Her principal dimensions are as follows:—Length, 285 ft.; breadth, 37 ft.; depth, 24½ ft.; gross tonnage, 2,100 tonss. The engines for this vessel were supplied by Messrs. R. & W. Hawthorne, and are 250-horse power. The speed on her trial trip averaged 12 knots an hour.

S. J. Oteri.—On April 8th, a steamer, named the *S. J. Oteri* which has been built by Messrs. Raylton Dixon & Co., of Middlesbrough, left the Cleveland Dockyard on trial trip for speed of her engines. She is a passenger steamer of 244 ft. length all over, by 31 ft. beam, by 16 ft. 6 in. depth of hold, having clipper stem and figurehead, fitted with poop aft, having a saloon fitted with accommodation for 24 first-class passengers, and bridge amidships and deckhouse forward for second-class passengers. She is built on very fine lines, and is designed for the attainment of great speed, as she is to be engaged in the fruit and passenger carrying trade between the West Indian Islands and New Orleans, where she is owned by Messrs. Oteri & Co. She is fitted with engines by Messrs. R. & W. Hawthorne, of Newcastle, of a nominal horse power of 210, but with large boilers working to 90 lbs pressure she attained on her trial trip an indicated power of 1,480-horse power, giving a continuous speed of 15·6 knots, or about 10 miles per hour.

Strathcarron.—On April 14th, the screw steamer *Strathcarron*, which has just been completed by Messrs. Dobson & Charles, Grangemouth, went down the Firth of Forth on her official trip. Although the weather was uncommonly stormy, the trial was considered highly satisfactory. The *Strathcarron* is of the following dimensions—125 by 26 by 10½ ft.,—having water ballast on the double-bottom principle. She is fitted with engines of 75-horse power nominal, by Mr. Kemp, of Glasgow, and has every appliance for the rapid loading and discharging of cargoes. She is owned by Messrs. James Hay & Sons, Glasgow.

Quirang.—On April 14th, the new iron screw steamer *Quirang*, built by Messrs. Blockwood & Gordon, Port Glasgow, for the Australian Steam Navigation Company, went her trial trip under very unfavourable circumstances as to weather. A speed of about 12 knots an hour was attained.

Gedeon.—On April 17th, the screw steamer *Gedeon*, which has been completed by Messrs. M'Intyre & Co., shipbuilders, Paisley, to the order of Messrs. Pile & Co., 34, Great St. Helen's London, went down the Firth of Clyde on her official trial trip. Although the weather was rough, the trial was considered highly satisfactory. The measured distance was run at an average speed of 10¼ knots per hour. The *Gedeon* is of the following dimensions :—182 ft. by 26 ft. by 11 ft., with a tonnage of 725 tons, and is fitted with engines of 400 indicated horse power by 80 H.N., on the newest principle, by Messrs R. H Pearson & Co., engineers, Crown Point and Paisley-road. She has been fitted with every appliance for the rapid loading and discharging of cargo. She is owned by Coudert & Co., Charente, and is for the French trade.

Haidar Pasha.—On April 18th, a new steamer the *Haidar Pasha*, intended for the service between Galata and the terminus on the Asiatic coast of the Ismidt Railway, was tried at the measured mile in Long Reach on the Thames. The vessel, which is of iron, has been built by Messrs. Samuda Brothers, of Poplar. She is 366 tons burthen, her length is 155 ft., breadth 22 ft., and draught 5 ft. She is a paddle-wheel steamer, and has a rudder at both stem and stern, so that she can run out of harbour either end foremost. Her engines, which have been constructed by Messrs. Maudslay, Son & Field, of Lambeth, are a pair of oscillating surface condensers, of 80-horse power nominal, intended to work up to about 450-horse power. The cylinders are of 37-inch diameter, and give a 3-ft. stroke. Four trials of speed were made on the measured mile about the time of high water, twice with the tide in her favour and against a fresh wind, and twice against the tide and with the wind, the mean speed being about 11½ knots per hour, with about 42 revolutions per minute.

City of Newcastle.—On April 18th the trial trip of the steamer *City of Newcastle*, owned by the Tyne and Wear Steamship Owning Company, Limited, took place. The vessel was built by Messrs. C. S. Swan and Hunter, and Messrs. R. and W. Hawthorn supplied the machinery. The steamer had 2,900 tons of cargo, including bunker coals, and on the measured mile she attained a speed of 10 knots per hour, which was considered very satisfactory.

Marion Lee.—On April 19th the screw steamer *Marion Lee*, of about 900 tons, recently launched by the Whitehaven Shipbuilding Company, and built to the order of Captain Gambles, of Heatherington, having had her machinery all fitted on board, proceeded on her trial trip to test the speed of the ship and working of machinery. The engines, which have been built by Messrs. Dunsmuir and Jackson, Govan, are about 80-horse power nominal, cylinders 22 in. and 44 in. by 30 in. Steel boiler, working pressure 90 lbs., gave great satisfaction, and the average speed of the vessel was about 10 knots per hour.

Satellite.—The *Satellite*, 8, composite sloop, 1,420 tons, 950-horse power, has just made an official, full-power trial of her machinery at the measured mile off the Maplin Sands, when the results obtained were very satisfactory in all respects. The trial possessed unusual interest, owing to the fact that the power contracted for—950 indicated horse power—had to be obtained without the use of the steam blast, and by means of the natural draught only. The result was exceedingly satisfactory, the power developed being largely in excess of the contract. The following are a few particulars of the trial :—The draught of water forward was 11 ft. 8 in.; aft, 14 ft. 9 in.; pressure of steam in boilers, 90 lb. on the square inch; vacuum in condenser, 26½; revolutions of engines, 98 per minute; mean indicated horse power, 114; speed of vessel, 12½ knots. The consumption of coal, when indicating the maximum power, was 1,833 lb. per indicated horse-power per hour. About the middle of the month the *Satellite* will be taken out for a series of steam trials of great interest, it having been decided to try what indicated horse-power can be obtained when using the funnel blast, and what indicated horse-power can be obtained by the use of enclosed stokeholes and a moderate forced draught. The results are likely to afford very valuable information to the Constructive Branch at the Admiralty, as the *Satellite* is the first vessel in the Navy fitted with all the appliances for forced draught and enclosed stokeholes, to be made use of when required.

Ealing.—A trial trip of the steamer *Ealing* took place lately. The vessel was built by Messrs. Hodgson and Soulsby, of Blyth, and is of the following dimensions :—285 ft. B.P. length, 36 ft. breadth, and 24 ft. depth, and engined by Messrs. R. and W. Hawthorn. The steamer is fitted with all the latest improvements: —Steam winches, steam steering gear, steel hawser in drums driven by steam, steam starting and turning gear, and Morton's patent furnace arrangements. At the run on the measured mile a speed of 12 knots was obtained. The engines worked smoothly, and the steamer was taken safely into the Tyne to load at the Commissioners' spouts. Everything passed off satisfactorily.

Hildegarde.—This new steamer, built by Palmers' Shipbuilding and Iron Company (Limited) for Messrs. J. and R. Bovey, of London, had a successful trial trip at sea. The vessel is 272 ft. in length, 36 ft. beam, and 23 ft. 9 in. deep. She has been built under the three-decked rules, and has iron shifting-boards, &c. She has Palmers' engines of 180-horse power nominal. The mean speed obtained was 11¼ knots.

TRIAL TRIPS.—SWEDISH.

Hven.—On March 3rd this steamer, built for "Det forenedi Dampskib selskab" at Copenhagen by the Motala Company, at their yard at Lindholmen, near Gothenburg, went on her trial trip. A sister-ship, *Saltholm*, built for the same owners, left the yard on April 13th for trial. The dimensions of the steamers are as follows :—Length, 148 ft.; breadth moulded, 23 ft.; depth of hold from top of keel, 10 ft.; height between decks, 7 ft. 3 in. The route will be between Denmark and Sweden, across the Oresund, with mail and passengers.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

To the Editor of THE MARINE ENGINEER.

SIR,—I beg to call your attention, and that of your readers, to an article written in the editorial columns of the *Mercantile Shipping Gazette*, dated Saturday, April 15th.

It is stated that they have received sundry representations that the state of the law requires considerable amendment regarding the persons who should be allowed to qualify for the position of 2nd class certificated marine engineers. The representations come from owners, *or* managers, *or* superintendents—so the writer states; from which it would appear that the editor is not well informed, if it is known at all who the people are who make the statements, causing the influence and abilities of the writers in the *Gazette*, to be used to further the interests of correspondents, whom, we must assume, are unknown even to the editor himself, which fact certainly does not make these persons, whoever they are, shine as authorities on the subject they write about, and which appears to convey such deep impressions to the writer of the article referred to, so much so, that a partisan spirit pervades the article when looked at and considered by any impartial reader.

There cannot be a doubt, sir, that at the present time, when every available ship is chartered if worth anything, that there are in all our large ports plenty of certificated engineers unemployed, who possess good characters, and who would be glad of employment in our mercantile marine, if the inducements were such as a good engineer could, with credit to himself, accept. I am certain that a dozen 1st and 2nd engineers of good character and abilities are always available at a few hour's notice in London. It is said that the character of all the unemployed will not bear investigation. I should like to know, sir, if that rule does not apply pretty equally to all classes and professions. The writer goes on to say a drunken or careless engineer, with a certificate, may not be so valuable to his employer as an uncertificated man of experience and of sober habits.

Neither, sir, would a doctor who gives way habitually to intemperate habits prove so reliable to a patient as a chemist who possessed a good character for sobriety and a fair knowledge of medicine.

These persons seem to lose sight of the fact that the Merchant Shipping Act deals severely with drunken engineers, as well as with drunken captains.

The fact is, that engineers on board ship are too often treated as necessary evils; not in the majority of cases probably, but in a good many instances the pay, berth accommodation, and food supplied are a standing disgrace to the owners of such steamships.

A comparison of the per centage of serious accidents which occur to engines and boilers, which are in land engines generally looked after by uncertificated engineers, and those under the charge of those properly certificated, leaves a considerable margin of credit to the latter class, and which leaves little room for doubt as to the desirability of maintaining the law generally as it stands. There are a considerable number of persons who advocate that, to keep pace with the times, the examinations for Board of Trade certificates should be made gradually non-stringent. There are a few men who will always find their level, and who, from firemen, occasionally become chief engineers, a proof that the law as it is does not stand in the way of real merit, notwithstanding shipowner's remarks in his statements to the editor of the *Shipping Gazette* that the examination is too exacting for the man who only serves four years in the engine-room.

I would venture to suggest that the most satisfactory results are gained by the shipowner obtaining the services of marine engineers similar to the general average of the mail steamship companies' engineers. Having since 1870 served in ships from a Royal Navy ironclad, merchant carrying ships, and passenger steamships of all classes, from 6th to chief engineer, I am justified, therefore, in expressing an opinion on this matter with all deference to the shipowners and others referred to, who have illuminated the idea of the writer of the article to which I refer. He cannot understand why a man who is eligible to act as second engineer with engines of 99-horse power cannot take charge of engines where the power is 100-horse power, and suggests that these handy men should be promoted to 2nd engineers where the power of engines is 200 and over; then we should, doubtless, be told by these same class of people that it is necessary that a still further step be taken in the same direction.

It does not apparently occur to our friend, the writer in the *Gazette*, that all legislation is based on the same principle, and that the line must be drawn somewhere, and I would certainly not suggest that he is so ignorant of the matter as some of his remarks imply. Finally, it is stated that it is open to the steamship associations to procure the introduction of a measure making it easy for the shipowning class to employ the class of men spoken of here; and it should certainly, on the other hand, be the duty of the various institutions of marine engineers to keep a sharp look out on such a measure if it is at any remote date introduced into the House of Commons. No doubt the *Liberal members* for Hull, Messrs. Wilson & Norwood, would give it the same liberal support which they generally accord to matters wherein their employés are concerned.—I am, sir,

Yours faithfully, A. C.

To the Editor of THE MARINE ENGINEER.

SIR,—Will any of your readers inform me if the chief engineer of a steamship is supposed to know the amount charged for repairs done to the engines on board.

I enclose my card, and remain,

Yours truly,
ALBERT TURNER.

THE SHIPWRIGHTS' EXHIBITION.—The Shipwrights' International Competitive Exhibition is the development of a like display set on foot by the Shipwrights' Company five years ago, with the co-operation of the Fishmongers' Company, in whose hall it was housed. The new exhibition will be inaugurated in the same place under the auspices of the same two City guilds on Tuesday, the 2nd of May; but this time the prize competition for models of ships of all kinds will be open to all nations. As was mentioned at the Shipwrights' Court dinner for the installation of the new Master (Lord John Manners) and the Wardens, his Royal Highness the Duke of Edinburgh has accepted the invition to become the patron and to preside at the opening ceremony. His Royal Highness will afterwards lunch with the Fishmongers' Company. Among foreign Governments, the United States, Japan, and Holland will send exhibits; Russia has intimated that, for the instruction of her shipbuilders, the Grand Duchy of Finland will be represented by two special experts, while the Norwegian Royal Navy has ordered to be made for the occasion a model, 5 ft. long, of the famous *Viking* ship, thought to be 2,000 years old, which was disentombed not long ago from the sand. According to the circular issued for the guidance of the home and foreign maritime interests, the exhibits will be ranged under the two general heads—steamers and sailing ships. Among the steamships, war vessels naturally come first. The scale recommended for models is a quarter of an inch to a foot. The classes comprise first-class sea-going ironclads, to carry heavy guns and act as rams; ironclads for coast or harbour defence; steel or iron corvettes of great speed; torpedo boats (scale half an inch to a foot) adapted for a speed of 25 miles an hour; ditto for speed of 18 miles an hour; and various other types of war vessels (for exhibition only). In this last class no prizes are offered; in each of the others there are three medals, gold, silver, and bronze. Mercantile steamers comprise the best mail steamers for the American trade between America, Great Britain, France, or Hamburg; steamers best adapted for a direct mail service between England and Australia, say, in 32 days; steamers of the largest class between Europe and the East, via the Suez Canal; the best Atlantic cattle and grain steamer; steamer for short sea passage of 30 miles, to best combine speed, comfort for passengers, and safety on a draught of water of, say, 9 ft. 2 in.; and river passenger steamer for the Thames, for the Mersey, and for the Clyde. Sailing vessels and yachts are also classified. Mr. ex-Sheriff Burt offers a prize of £50 for the best system proposed for the improved ventilation of passenger vessels.

RECENT IMPROVEMENTS IN NAVAL ARCHITECTURE.

BY MR. PEARCE.

I PROPOSE to confine my remarks to the leading features which present themselves in a retrospect of the last five-and-twenty years. This leads us back to the close ot the first decade of the free trade policy inaugurated by the late Sir Robert Peel—a policy which had, even then, given an impetus to the interchange among the nations of the varied productions of the earth and of the industry of man, culminating at the present time in a carrying trade as vast as it is beneficial to mankind. It takes us back to the close of the Crimean War—a war which showed us our deficiency in ocean transport, and gave the first great impulse to the construction of first-class iron screw steamers. The fruits of this were reaped by the nation in the promptitude with which, a couple of years later, we were able to respond to the cry for help which came to us from our countrymen in India. Since then, with the aid of our magnificent mercantile steam marine, we have been enabled to make the power of this country felt, wherever our honour or our interests have been attacked, with a celerity which has made our small but splendid army practically ubiquitous. In 1856, iron had asserted its supremacy over wood as a material for the construction of steamers, and the screw had likewise, to a very large extent, superseded the paddle. It was not, however, until some half-dozen years later that the Lords of the Admiralty consented to sanction the use of the screw by the Cunard Company in their splendidly-conducted mail service across the Atlantic. The *Scotia* launched in 1861, was the last paddle steamer built for this company. In 1857 there was launched into the Thames the *Great Eastern*, the greatest ship ever built, and the greatest failure financially. This steamer was constructed of iron, with the avowed object of carrying passengers comfortably and merchandise economically, but unhappily the paddle and the screw were combined as propelling powers, and the machinery used for driving these was of the ordinary type of low-pressure engines, involving an enormous consumption of fuel without adequate results. Had Mr. Brunel adopted the principle of the compound engine, the fate of the great ship and the finances of her shareholders might have been very different. Both screw and paddle laboured under the very serious disadvantage of being worked by low-pressure steam and the ordinary condensing engine—a disadvantage which made a long voyage, such as hence to Australia, under steam only practically an impossibility. The main body of the ship was occupied by engines and boiler, and the greater part of the remainder was filled up with coals. Messrs. Randolph, Elder & Co. had, so early as 1854, adapted the compound principle to marine engines, the *Brandon* having been the first vessel in which they were fitted; the steam pressure of the *Brandon* was limited to 42 lbs. Later on a pressure of 60 lbs. was carried, and this, as you are aware, has since been successfully increased to 70, 80, and even 100 lbs., the relative dimensions of the cylinders being altered accordingly. A little later the surface condenser was added, circular multitubular boilers were brought into use, and the compound engine then became a machine which has revolutionised the carrying trade of the world. In spite of the splendid success of the compound engine and surface condenser, the great steamship companies and ship-owners generally were very slow to adopt it. The Pacific Steam Navigation Company was by many years the first to do so, having commenced as early as 1856, when Messrs. Randolph, Elder, and Co. built for them the *Valparaiso* and the *Inca*, followed in rapid succession by forty-seven other vessels, besides one now in hand, making in all fifty for that company by the firm I represent and their predecessors. One or two private shipowners followed the example of the Pacific Steam Company in adopting the compound engine, but so wedded were the leading engineers of the day and the marine superintendents of the great companies to the old type of low-pressure engines that for many years they continued to fit them on board steamships, to the serious loss of their owners. This loss can best be appreciated when it is considered that the old type of engines required from four to five pounds of coal for the development of each indicated horse-power, whereas the best type of the compound engine requires as little as one and three-quarter pounds to give the same result; while the boilers last about double the number of years they did with the low-pressure engines without the surface condenser. Nearly all, if not the whole, of the larger class of steamships so fitted have had their engines converted into compound engines, or have had entirely new machinery supplied to them, or have been transformed into sailing ships. It was not until about the year 1869 that the compound engine came into general use, and it was only in 1872 that the Cunard Company and the Peninsular and Oriental Company took it into favour, their eyes having been, no doubt, opened by the success of the fleet of steamers of the new type which the opening of the Suez Canal in 1869 brought into existence. During the period we have under consideration many minor improvements have been made both in the engine and ship departments, such as steam starting and reversing gear, steel shafting, improved forms of propellers, steam windlasses, steam cranes and winches, and steam steering gear. Very recently we have seen steel brought into competition with iron as a material for the construction of hulls and also for boilers, especially in cases where ability to carry heavy cargoes requires to be combined with light draught of water. Whether steel will materially encroach on the employment of iron will depend, to a very large extent, on the skill and care of the steel manufacturers in producing an article of equal and sufficient purity, strength, and power of endurance at a moderate cost. A few figures will give you an idea of the results of the improvements to which I have alluded, and I shall take them, in the first place, from the greatest of our ocean highways—that between Liverpool and New York. After one or two unsuccessful attempts to establish a regular steam communication between this country and America, the Cunard Company, which we are proud to regard as a thoroughly Clyde concern, was formed in 1840, and has ever since kept well to the front. Fortunately for them, as well as for the cause of progress, they have not had it all to themselves, and have been compelled by keen competition to keep up with the times. Their first steamers were under contract to go at a speed of 8½ knots per hour; they indicated 740-horse power, and consumed 4 7-10 lbs. of coal per indicated horse-power. The speed and power were increased from time to time, and when the Americans put on the Collins Line it was found necessary to step out and put on steamers which went 12 to 12½ knots, indicating 2,000-horse power, and consuming a fraction under 4 lbs. of coal per indicated horse-power. These steamers made the passage, on an average, in twelve days and nine hours outwards, and eleven days eleven hours homewards; but the Collins Line averaged only eleven days eight hours outwards, and ten days twenty-three hours homewards; and the *Persia*, and others of her class, had consequently to be put on to compete successfully with the American line. The *Persia* was an iron paddle-steamer, built in Glasgow in 1856, and was the best type of a vessel of her description of her day. She performed her voyage between Queenstown and New York, on an average, in 10½ days. She was fitted with side-lever engines, indicating 3,600-horse power, and consuming 3 7-10th lbs. of coal per indicated horse-power. She attained an average speed of 12 9-10th knots, and consumed 150 tons of coal per day. The *Gallia*, belonging to the same company, was built on the Clyde in 1879, and was fitted with engines on the compound principle, indicating 5,000-horse power, and consuming only 97 tons of coal per day. Her fastest passage was accomplished in 7 days 21 hours, and her average speed may be fairly taken at 15½ knots. The engines, boilers, and bunkers of the *Persia* occupied so much space and immersed her floats so deeply that she took no heavy cargo whatever, but besides passengers she had always about 800 tons measurement of light goods, equal to about 250 tons weight. To obtain this room great competition existed, and the freight of £4 per 40 feet was readily paid, or about £10 per ton weight. The *Gallia* carries, besides her passengers, fuel, stores, &c., 2,000 tons measurement, or 1,700 tons weight, of cargo, for which 20s. is considered a fair rate, and is competed for. Consequently, the *Persia* burned on her voyage 6 1-3rd tons of coal for every ton of cargo she carried, while the *Gallia* burns something less than half-a-ton of coal for every ton of cargo she delivers, although she carries it two-and-a-half knots an hour faster. The last comparison has been made between the two vessels of the Cunard Company—a paddle and a screw. I shall now compare the *Pereire*, which designed and built at the yard of the late firm of Robert Napier & Sons, in 1865, with the *Arisona*, designed and built by my firm in 1879. The *Pereire* was a screw steamer built of iron, and fitted with engines of the ordinary description, indicating 3,300 horse-power, and consuming 110 tons of coal per day, and steamed at the rate of 14¼ knots on her voyage. Whilst the total weight of the *Pereire*, as she proceeded to sea, was no less than 4,944 tons, all the cargo she could carry was only 240 tons dead-weight; so that to carry each ton of cargo from Havre to New York she consumed 5½ tons of coal. The *Arizona* indicates 6,000 horse-power, and consumes 1¾ lbs. of coal per indicated horse-power, or about the same amount of coal per day as the *Pereire*. She attained a speed of 17½ knots on the measured mile, and carries, in addition to her coal and her passengers, 3,400 tons weight of cargo, and when fully laden, steams steadily at the rate of 16½ knots an hour. She thus burns about 5 cwt. of coal for every ton of cargo she carries, and carries it two knots an hour faster than the *Periere* did in her day. The *Arizona's* quickest passage was accomplished in seven days and eight hours, and is the fastest yet recorded. Steam communication with Australia and New Zealand, until the improvements I have indicated, appeared to be, financially, impracticable. It has now been established on a sure basis. Not only are there two subsidised mail routes—the one by the Suez Canal, and the other via San Francisco—but the Orient Company have established a direct unsubsidised and independent service, going out via the Cape of Good Hope and returning via the Suez Canal, delivering letters 10 or 12 days quicker than the older subsidised lines. The Orient on her last trip delivered her Adelaide letters in London in 31 days. On the great Atlantic road, fresh preparations are being made for the struggle for the first place in safety, comfort and speed, and it is more than probable that we shall, before the end of the current year, see the voyage between New York and Queenstown made in a little over six days. Great as have been the improvements made during the last 25 years, their results should only incite naval architects and engineers to further efforts to improve not only the machinery, but the form of the hull itself. Until quite recently, all attempts to improve the form of the hull ran pretty much in one groove, if we may except the twin ship, the cigar ship, and one or two others. A few years ago the Admiralty constructed, at Torquay, a basin for the purpose of making experiments in hydrodynamics, fitted up an establishment there, and placed it under the care of that talented man the late Mr. William Froude, who invented and constructed all the requisite delicate machinery. Here, in a few weeks, more true knowledge of the resistance due to special forms can be acquired than in a whole lifetime of costly experiments at sea. A similar establishment was inaugurated at the Royal Dockyard at Amsterdam, under the superintendence of my friend Dr. Tidemann. I am quite aware that when it became known that my firm had undertaken to construct the *Livadia* for the Russian Imperial Government, in accordance with the designs of his Excellency Admiral Popoff, and that we had guaranteed to propel her, with engines of a specified weight and power, at least 14 knots an hour, with the provision that in case of failure the Government was not obliged to take the vessel, many of my friends shook their heads mournfully, and thought I was a very rash man—10 knots being the highest speed they allowed to be possible with such a form of vessel. Before I signed the contract for the *Livadia*, a model of her form had been for several months under the care of Dr. Tidemann at the Royal Dockyard at Amsterdam, and a series of carefully-conducted experiments had made it an absolute certainty that, with proper machinery, a speed of at least 15 knots would be attained. The average speed actually got was considerably over this, her engines having given out greater power than engines of the same size had usually accomplished; and it is a fact, which may be worthy of notice, that these engines gave out a mean power of 12,354 indicated horse-power, the total weight of engines, boilers, and water being 1,370 tons, or upwards of 9-horse power for every ton of weight.

Allow me, in conclusion, to draw your attention to the necessity that exists for such establishments as those at Torquay and Amsterdam being brought within easy reach of the Clyde builders and engineers. Looking at the fact that the nation in the long run reaps the benefit of all improvements in naval construction, and that so many of these emanate from this river, we might well ask Government to assist us; but we have always in this part of the country being partial to self-help, which is the best help of all. I hope this matter will be warmly taken up, and shall be only too glad to do all in my power to aid in giving it a start. Such an exhibition as that we now have the advantage of inspecting reflects the highest credit on the committee that organised it. The great number of visitors shows how generally the profession it illustrates meets with the sympathy of the public, and truly the public may well be interested when they reflect on the vast extent to which they are dependent on naval architecture for the necessaries and luxuries of life. This last year we had 180 millions' worth conveyed to us from foreign countries. Our steam merchant fleet had increased from 1,350 steamers in 1850, measuring 187,000 tons, and 2,357 steamers in 1860, measuring 500,000 tons, to 6,629 steamers in 1879, measuring 2,730,000 tons, or one million of tons more than the merchant steamers of all the rest of the world put together. We carry on not only the bulk of our own vast commerce, but we assist every nation that possesses a seaboard to carry theirs. We ask no protection, no bounty, but we do ask that our Government will do their utmost to prevent our trade from being insidiously attacked by foreign Governments granting bounties in order to foster their merchant marine; not that we need fear in the long run any fostered industry—competition is the very soul of true work; but we may in the immediate future be exposed to an undue and unfair rivalry.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 24th March to 22nd April.

1379 J. M. B. Baker. Extinguishing fire.
1381 J. J. Tyler. Marine governor.
1402 F. Deloye & A. Guebhard (communicated to J. Imray). Tubular boilers.
1409 H. Reusch. Armour plates for ships.
1415 J. E. Commerell. Ship's rudders.
1516 P. W. R. Williams. Binnacles.
1417 W. Smith. Dredging hoppers.
1425 A. Pengelly & R. Day. Water velocipede.
1427 T. English. Variable expansion gear.
1430 K. Anunsen (communicated to A. W. Clark). Motive power for ships.
1436 J. Z. Cressy. Adapting ship's furniture for saving life.
1443 J. Armstrong. Indicating speed of ships.
1463 W. H. Skipper. Dress and equipment of divers.
1471 W. V. Ley. Metallic packing for piston rod stuffing boxes.
1474 D. Farcot (communicated to W. R. Lake). Steam engines.
1490 A. Morton. Steam engines.
1518 W. Naylor. Projectiles.
1524 J. Jaques. Buoys.
1530 J. Burton. Fusible plugs.
1558 Edmund Truman. Governors.
1592 J. Vavasseur. Projectiles for rifled ordnance.
1638 R. B. Clark (communicated to J. H. Johnson). Armoured vessels.
1650 John Penn. Marine steam engines.
1666 G. Stevenson. Steam boilers.
1668 W. N. Hutchinson. Submarine torpedoes and apparatus for laying the same.
1675 D. Halpin. Slide valves.
1695 G. H. T. Beamish. Breakwaters.
1703 E. Palliser. Projectiles for ordnance.
1704 E. J. Robertson. Rowlocks.
1705 R. E., M., & M. Williams (communicated to A. M. Clark) Condensers for steam engines.
1709 T. Britton. Steam and hand steering gear.
1710 R. S. M. de Ricci. Ordnance machine guns, &c.
1714 John Cran. Steam or air whistle.
1735 A. A. Rickaby. Piston packing rings.
1734 C. Gamper (communicated to R. H. Brandon). Steam boilers.
1767 F. G. Crofton. Disengaging ship's boats.
1786 J. Alexander (communicated to W. Rhake). Ship's sleeping berths.
1792 A. Huber (communicated to A. W. L. Reddie). Ventilators for ships.
1796 C. R. Wymer. Starting, stopping, reversing, &c., marine engines.
1806 A. L. S. Leigh. Casing for ship's torpedo boats.
1811 H. O. A. E. Grunbaum. Preventing collisions at sea.
1814 John Nelson (communicated to L. A. Groth). Automatic alarm sound apparatus.
1815 L. Treyre (communicated to L. A. Groth). Breechloading ordnance.
1825 P. Langenstnin (communicated to G. W. Von Naivrocki). Pistons.
1832 F. Holtschmdt (communicated to W. A. Barlow). Automatic lubricators for steam cylinders.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

April 1st, 1882.

Bathgate, Geo.	1 C	Sndrlnd.
Bewicke, Jno. W.	2 C	N Shlds.
Blackwood, J.T.	2 C	do.
Boucher, Chas. P.	1 C	Lvrpool.
Cavins, George	2 C	Sndrlnd.
Crow, Chas. S.	1 C	do.
Davidson, Jas.	1 C	Glasgow.
Doxford, Jacob	1 C	Sndrlnd.
Eaglesome, H.	2 C	London.
Hardie, William	1 C	Glasgow.
Highen, Robert	1 C	do.
Hunter, James	2 C	Cardiff.
Johnson, R.B.M.	1 C	Sndrlnd.
Jones, James ...	1 C	Glasgow.
Livingstone, J.	2 C	do.
Martin, Wm. C.	2 C	London.
McKinnon, D.	2 C	do.
Mitchell, Jas. C.	1 C	Glasgow.
Munn, James	2 C	Lvrpool.
Nicholson, R.W.	1 C	Lvrpool.
Prahm, A. C. C.	1 C	Plymth.
Raine, Jas. K.	2 C	N Shlds.
Ross, Wm. A.	1 C	Sndrlnd.
Smith, Robert	2 C	Glasgow.
Westerberg, O.	2 C	N Shlds.
Wilson. John ...	1 C	do.
Wood, J. S. ...	1 C	do.
Young, Thos.	2 C	London.

April 8th, 1882.

Barclay, John	1 C	Lvrpool.
Brown, James	2 C	Glasgow.
Carsley, Joseph	2 C	Lvrpool.
Cherry, Samuel	2 C	Glasgow.
Coombs, Alfred	1 C	London.
Edwards, Alex.	1 C	Lvrpool.
Kingswood, R. W.	2 C	London.
Latimer, F. N. G.	2 C	Lvrpool.
Lorentsen, C. A. W.	1 C	London.
McDonald, D.	2 C	Glasgow.
Orr, James ...	2 C	do.
Pickering, Wm.	1 C	N Shlds.
Pohl, William	2 C	Lvrpool.
Reynolds, T. E.	1 C	Sndrlnd.
Sayers, Thomas	2 C	Lvrpool.
Shaw, John A.	2 C	London.
Stenhouse, A.	1 C	N Shlds.
Taylor, Alfd. E.	1 C	London.
Thomas, Thos.	2 C	Bristol.
Wetherilt, Hny.	1 C	London.
Wickett, T. C.	2 C	Bristol.
Wright, John	2 C	Lvrpool.
Yale, John ...	1 C	London.

April 15th, 1882.

Anderson, Robt.	1 C	Grnock.
Barbour, John	1 C	Plymth.
Barclay, Archbd.	1 C	Glasgw.
Baxter, Peter ...	2 C	do.
Boleyn, Thomas	2 C	Leith.
Campbell, Jas.	2 C	Glasgw.
Campbell, Peter	2 C	do.
Cochrane, John	2 C	Lvrpool.
Coutts, Alex. ...	2 C	Leith.
Fairie, Thomas	2 C	Glasgw.
Harris, Frank	1 C	Plymth.
Irvine, Walter F.	1 C	Glasgw.
Jago, Wm. R.	2 C	Lvrpool.
Kater, Alex. ...	1 C	Glasgw.
Keith, Hugh ...	1 C	Lvrpool.
Kelly, Wm. Gass	2 C	Glasgw.
Laurie, Robt. R.	2 C	Leith.
Leask, Alex. R.	2 C	Leith.
Mace, Andw. H.	1 C	London.
McKenzie, John	2 C	Cardiff.
McLachlan, Jno.	1 C	Glasgw.
Murray, John ...	1 C	do.
Murray, Alex.	1 C	do.
Nicholls, G. H.	2 C	London.
Norris, Colin M.	1 C	Plymth.
Paterson, Wm.	2 C	Leith.
Perivancich, F.	1 C	Glasgw.
Ross, Craigie ...	2 C	Leith.
Rothery, George	2 C	Glasgw.
Sclanders, Jas.	1 C	do.
Seaton, James	2 C	N Shlds.
Sheldrick, Saml.	1 C	Cardiff.
Simpson, John	1 C	Glasgw.
Skinner, Thos.	1 C	Leith.
Snowdon, John	2 C	London.
Watson, John	2 C	Lvrpool.
Watt, James ...	2 C	Greenock
Williams, S. J.	1 C	Cardiff.
Wills, Henry ...	1 C	Lvrpool.

April 22nd, 1882.

Austin, Wm. R.	1 C	Lvrpool.
Bendell, Wm. N.	2 C	do.
Curling, J.J. (Mstr. of his own yacht)		London.
Dewar, Hny. R.	2 C	London.
Hastings, John	1 C	Hull.
Henderson, Ptr.	2 C	N Shlds.
Hill, Thomas ...	2 C	Hull.
Jackson, A. J.	1 C	London.
Lawn, H. E. ...	2 C	Hull.
Lowrie, James	2 C	N Shlds.
McKinnon, Jno.	2 C	London.
Melville, Thos.	2 C	Leith.
Richardson, J. H.	2 C	Hull.
Sherren, R. J.	1 C	London.
Smith, Thos.	2 C	N Shlds.
Snaith, Thos. W.	1 C	do.
Thompson, N.	2 C	London.
Vosper, David	2 C	Cardiff.
Washington, T.L.	2 C	Lvrpool.
Wilmott, J. ...	2 C	London.

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NOTICE.—Owing to great pressure on our space, we are obliged to hold over the articles on "Our Royal Marine Engineers and Engine Room Artificers," and the article on "The Carpenters of the Royal Navy, their Duties, Responsibilities, and Neglected Position," until our next issue.—ED. M. E.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

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The Marine Engineer.

LONDON, JUNE 1, 1882.

EDITORIAL NOTES.

IT seems we have by no means reached the ultimate forms of development of torpedo warfare. Not content with all the horrors of insidious torpedo attack by rapid low-lying launches, the Russian Government have been building a large number of submarine torpedo boats. They are the invention of M. Dgevetsky, a native Russian, and have proved very successful in their operation. They are about 20 feet in length, and of cigar shape, capable of carrying four men, and are fitted so as to be raised like ordinary cutters on the davits of ironclads. These boats, built of iron, are hermetically closed, and are of such density that they float just immersed in water. Weights are provided upon side horizontal guide rails, so that they can be moved fore or aft, causing the boat to depress at the bow or stem respectively. When depressed at the head, the boat sinks and can be made to travel at any required depth. At present the boat is driven by a screw operated by the feet of the crew. This enables the boat to travel at the rate of about four miles an hour, which is sufficiently rapid for the purpose of attaching the torpedoes to a ship's bottom. The torpedoes are carried by levers in front of the boat, from which they can be instantaneously detached. They are provided with pneumatic suckers, which cause them to remain securely attached to the bottom of the ship. The submerged torpedo boat then retires, retaining the connecting electric wires. By means of an electric current the torpedo is exploded with the usual disastrous consequences, whilst the author of the mischief lies hidden below the waves. Sufficient air is stored on the boat to last for 24 hours, and the exhaled or poisonous carbonic acid is absorbed by chemicals. These submarine boats are now to be fitted with electric engines to give them greater speed without labour. A glass dome is provided, through which the officers or crew can direct the movements of the boat.

IT is much to be regretted that the proportion of foreign seamen in our mercantile marine to native British seamen is so large. The percentage of risk of ultimate loss of the vessel in cases of imminent danger must be greatly increased, and also the tendency to mutiny and disorder. From a national point of view, also, the mercantile marine is the nursery and the reserve for our navy in case of war. The present system of enrolling a crew of any nondescripts that will ship for low wages deprives a most valuable class of hardy seamen of suitable employment. Many of them ship in American and foreign services, where their value is more highly appreciated, so that in case of any naval conflicts in the future, we should find ourselves fighting our own countrymen. It is, of course, a well-accepted rule that price regulates supply and demand, but inasmuch as cheaper labour constitutes an extra risk, we think the underwriters might largely aid to adjust the market. By putting extra risk on those vessels which have lower than a certain percentage of British seamen, the present demoralizing excess of foreign seamen might be kept down. In passenger vessels, also, where much legislation is enforced as to regulations for safety, &c., we think that such an important matter as this should not be overlooked.

We see that the third Annual Report of the Association of Sea-going Engineers is lately issued. We are glad to note that this Association flourishes, and that it has that most crucial test of the success of any institution, an increasing cash balance in hand. We are very desirous to calling the attention of all our readers to this flourishing Association, as it is just such unions of special trades that serve to give dignity and self-respect to any body of men. The information which marine engineers can obtain from this Association in the matter of colonial berths must be invaluable, and the general interchange of information between the several branches must be of the greatest service to members. The principle of insurance in case of sudden death is now so generally recognised that it is unnecessary for us to dilate upon the advantages offered in this way by the Association. The special advantage, however, of legal assistance offered through a solicitor retained as officer to the Association is a very valuable feature. The advice received in such case by a proposing litigant is sure to be disinterested as to probabilities of success, and the charges incurred in unavoidable cases are met with ease by such a system of co-operation.

It seems that we are to have the bridge across the Firth of Forth after all. The sad accident to the Tay Bridge so put the world in general out of conceit with these long exposed estuary bridges, that it was anticipated that the proposed bridge over the Firth of Forth would be ultimately abandoned. The Select Committee, however, of the House of Commons at present sitting on the subject has passed the Bill authorising the construction of a new bridge, which is calculated to sustain a rolling load three times greater, and a wind pressure five times greater than was at first anticipated. This is from the designs of Mr. Fowler, assisted by Mr. T. E. Harrison (of the North Eastern Railway), and Mr. Barlow. The Board of Trade are closely watching the designs, which have been approved by a committee of that Board, and the work is to be carried out under the inspection of an officer deputed from the Board. The bridge is almost exactly a mile in length, and consists of two principal central spans of 1,700 feet, and two principal side spans of 675 feet. As the height of the headway at high water is 150 feet, this should allow easy navigation. The whole bridge is to be of steel, and will cost £1,730,000. Where the money will come from, and how it will pay, seems to us a doubtful matter.

A very great improvement in marine boilers has been quietly working its way without much fuss or notice. We refer to Fox's Corrugated Flues, made by the Leeds Forge Company, of which we are informed no less than seventy-six sets for as many steamers were delivered to the Clyde last year. To those of our readers who are not acquainted with these flues we may explain that they are formed of plates circumferentially corrugated to a depth of about 3 inches. The effect of this corrugation is very greatly to increase the stiffness of the plates, probably as much as five times, thickness for thickness. Instead of Yorkshire iron the Leeds Forge are almost entirely making their flues now from mild steel or ingot iron. Under ordinary pressures considerably less thickness of plate than usual will suffice, and where the usual dimensions are used the proof test may be enormously higher. Those supplied to the *Aberdeen* were, together with the boilers to which they were fitted, subjected to a test pressure of 250 lbs. per square inch. Besides the seventy-six sets of flues referred to as supplied to the Clyde, thirty-eight sets have been supplied to steamers building elsewhere, making 114 sets in all.

There still seems to be a great *desideratum* for more accurate and prompt powers of steering amongst vessels, which at any time have to navigate through narrow rivers. As most steamers in approaching their loading wharves or docks have to pass through more or less tortuous river navigation, and none more so than those which travel to and from the port of London, we may consider rapidity and power of prompt steerage-way is a very general *desideratum*. The chief difficulty to be dealt with is the necessity with the use of the ordinary rudder that there shall be considerable way upon the vessel. If dropping down in a current or tide-way it is very probable that it may not be safe as regards speed in crowded water-ways, to give little or no speed to the vessel relatively to that of the current or tide. If so, how is the vessel to steer at all when required. The only solution under such circumstances, is that the screw itself shall have a directing as well as a driving power, or that a rudder shall be power moved, and of sufficient area and size to cause, by a sudden movement, an immediate divergence of the vessel's head. This latter action would correspond to that of a steering oar and we do not see why such an arrangement might not be easily applied with advantage. The other alternative arrangement of giving the propeller a power of direction, when single, has been attempted by carrying the propeller in the rudder, connected by a universal joint, to the main shaft. That this will give a valuable power of prompt divergence of direction there can be little doubt, but we fear the constant strain and vibration of the propeller on the rudder and hinges will materially reduce the life-time and durability of that important fitting.

THE S.S. AUSTRAL, OF THE ORIENT LINE.

THE latest addition to the Orient Line of steamers, the *Austral*, arrived in the Thames on May 1st from the Clyde, after a remarkably short passage. She left the Cumbrae Head at 5 o'clock on the afternoon of April 29th, and passed the Margate Sand Buoy, after a run of 42 hours and ten minutes. This gives a speed of 16·10 knots for the voyage. The tide was against the ship the whole way, except during three hours, and she had to contend against a south-west wind from the Tuskar light to Land's-end. The vessel is a distinct advance on the *Orient*, the first of her type, not only in respect of speed, but in the structure of the hull, the ventilation of the state rooms, the arrangements made for the importation of frozen meat from Australia, and the effectiveness of the vessel as an auxiliary to our naval force. She has been built by Messrs. John Elder & Co., of Fairfield, Govan, under the superintendence of Mr. J. W. Shepherd, a member of the Institute of Naval Architects. Her length over all is 474 ft., her breadth 48 ft. 3 in., and her depth moulded is 37 ft. Her displacement on the load line is about 9,500 tons. She is thus 10 ft. longer, 2 ft. broader, and 2 in. deeper than the *Orient*, but, inasmuch as her lines are finer, her tonnage will not exceed that of the *Orient*. She has been built throughout of mild steel, and has three steel decks. The lightness of the material of which she is constructed causes her to draw comparatively little water, and it may be said that it will be hardly possible to sink or burn her. She is divided below the inner skin and the double bottom into 19 separate water-tight compartments, and in the hull proper within the interior skin she is divided by 13 water-tight bulkheads, ten of which run up to the level of the main deck. If the whole of the lower compartments were filled with water, the effect would be an additional draught to the extent of 18 in., and if by accident or design the sea obtained free communication with any two of the holds, the stability and surplus buoyancy of the vessel would prevent her from being endangered. Above the main deck the ship is divided into seven fireproof compartments, all of which are in communication with the main deck; and, as the pumping power provided is equal to 2,928 tons per hour, there is ample arrangement made for flooding any of the holds or compartments in case of fire, or extracting the water in case of their becoming waterlogged. In the event of the engines being disabled, the vessel is provided with four masts, the fore and main being square-rigged, and the mizzen and jigger having fore and aft sails, which combined, will give about 28,000 superficial feet of canvas; and thus the vessel will be well under command independently of steam power.

These provisions for the general safety of the vessel are supplemented by unusual care for the comfort of the passengers. In almost every particular some advance has been made, bringing the accommodation as nearly as possible to that offered by an hotel. It will be a surprise to most people to hear that passengers by the *Austral* can be furnished with accommodation for private dinner parties. Rooms capable of dining parties of ten are provided, and the saloon is furnished with small tables to accommodate quartettes, as well as larger companies. Hospitals are provided for passengers of all classes, and even the third-class passengers have a bath-room specially reserved for them. The greatest improvement observable in the arrangement of the ship, however, is the position in which the cabins are placed in relation to the sides of the vessel. A ship's cabin is usually associated with ideas of smallness and stuffiness. Ventilation is in most cases procurable only at the expense of a sea bath, and the wall of the state room being, with few exceptions, the skin of the ship, the temperature is subject to great variation. In the Austral a radical change has been made. The cabins are all placed within the area of the ship, with a gangway, 4 ft. wide, running right along the vessel on the outside of the state room and at frequent intervals across the ship. This permits the state room to be constructed like an ordinary compartment, with windows instead of portholes, and it further permits the actual porthole in the side of the ship to be opened even in rough weather without any fear of water entering the cabin. If a sea should strike the vessel when the porthole is open, the water will fall on to the gangway; and upon the upper deck the state rooms are still more open to the admission of fresh air, because the gangway running round the whole of the vessel is perfectly open to the air, and while it is covered above the passengers may promenade there with the full advantage of an open sea before them. The state rooms are ventilated in a somewhat novel manner. The fresh air enters from the windows as may be desired, and by an opening over the berths the warmer air will pass up into an air chamber which, passing from the main-deck state rooms, ascends to assist in drawing off the foul air from the upper-deck state rooms. Arrangements are made for admitting the foul air in some cases into a chamber surrounding the funnel, or it may in other cases pass outward to the side of the vessel. The general arrangements give to the passengers all the advantages and freshness of a deckhouse combined with the protection from severe weather that a low-deck state room affords. The passage round the ship leads fore and aft on each side of the saloon, so that persons going to either end of the ship can do so without passing through the saloon. Beside this there are numerous cross passages two feet wide between the several quadrangles of state rooms, an arrangement that offers unusual facilities for moving about the ship. The saloon is a handsome apartment, panelled with walnut and embellished with carved shields representing the arms of the various nationalities. Arrangements are provided for the usual long tables, but they can be also split up into sets of a dozen or even four. The most striking characteristic of the saloon, however, is the row of dome-shaped painted glass windows down each side. These can be lowered at will in all weather, because instead of opening on to the sea as is usual they merely admit air from the long corridors. When the vessel is in port the arrangement gives a somewhat heavy appearance to the saloon, but on the open sea they admit abundance of light. As the vessel is designed for equatorial as well as temperate waters, the ruby leather cushions on the chairs and couches are removable and cane is provided as a substitute. The same arrangement is made in the ladies' saloon, a charming semi-circular apartment, having large portholes looking in every direction forward. Not only does the vessel provide for private dinner parties, but passengers may, if they choose, engage a suite of apartments giving them the advantage of a sitting-room separate from their berths. The first-class baths are of marble, and the lavatory accommodation for all classes is unusually abundant. Effective ventilation is provided for the saloon by a centrifugal fan, worked by a small steam-engine. The fan forces a continuous current of pure air into the apartment, and the foul air finds its way out through an ornamental opening above each window. The whole of the public rooms, the engine-room, pantries, and passage ways are lighted by the electric light, fitted up by Messrs. Siemens. The scheme comprises nine arc lamps and 170 Swan lamps. Five of the arc lights are placed in the engine room and four on the deck. The current is provided by two of Siemen's alternating current machines, each driven by a separate engine strong enough to drive them both. The arc lights give a power of 3,600 and the swan 3,400, or a total of 7,000 candles.

The propelling machinery of the *Austral* is similar in design to that usually favoured by John Elder & Co. They consist of a compound inverted cylinder surface-condensing engine, having one high-pressure cylinder 62 in. diameter, and two low-pressure cylinders each 86 in. diameter, with a stroke of 5ft. Each cylinder is fitted with two equilibrium piston slide valves in lieu of the ordinary flat slide valve. Steam and hydraulic gear are provided for reversing and handling the engines when required. Two surface condensers and pumps are placed at the back of the engines, each low-pressure engine being connected to its own condenser and air-pump. The water is supplied to the surface-condensers by means of two large centrifugal pumps with independent engines. These pumps are placed high up in the engine-room, and have connections to the bilge. They are capable of discharging 200 tons of water per hour. A centrifugal pump is also fitted for pumping in or discharging water ballast, with connection to the bilge. The crank-shaft, which is of best steel, is what is usually known as a built shaft, while the propeller-shaft is hollow and of compressed steel. The propeller has four blades of neutral manganese bronze, the boss being of cast-steel. The pitch of the screw is 30 ft. It is 22 ft. in diameter, and presents 140 ft. superficial area. The neutral manganese bronze, on account of its great strength and ductility, admits of the blades being made much thinner than is necessary with other metals. This, together with the smooth surface obtained, has considerable advantages over the ordinary thick rough blades in propelling the vessel. The boilers for supplying steam are four in number, and are made throughout of mild steel. They are cylindrical, and fired from both ends, being 16 ft. in diameter and 17 ft. long, with six furnaces in each. The working pressure is 95 lb. per square inch. There is the usual compliment of fire-engines and pumps, and the auxiliary engines for various purposes, usually fitted in first-class vessels of the size.

At the trials of the vessel in the Clyde on April 20th, she steamed the measured mile at the rate of 17·3 knots, and the day before she steamed for six hours at a speed of 17 knots, or, in other words, made a run of 35 knots in two hours and three minutes. The speed on the trip to the Thames was at the rate, as already stated, of 16·10 knots per hour. The contract stipulated for 5,800 indicated horse power; but the engines actually developed 7,114·36 and while it is customary to allow two pounds of coal per hour for every horse power indicated; in this case the consumption was 1·3 pounds. The propeller gave 64 revolutions to the minute and maintained the speed without intermission throughout the voyage south. Her behaviour during the heavy weather of Sunday morning was all that could be desired. The engines throughout were under the control of Mr. Bryce-Douglas, the head of the engineering department of Messrs. Elder & Co.

A point of great interest in the vessel is the magnitude of the arrangements made for carrying frozen meat for the supply of the English market. The refrigerator used for the purpose is a novelty in itself. It is the invention of Mr. Bryce-Douglas, and while most refrigerators hitherto used add to the moisture of the air in the process of cooling, this one not only extracts the heat, but expels the air drier than when it receives it. To make its operations clear to the non-technical mind, we may imagine 100 cubic feet of air compressed by a pump to the dimensions of 1 cubic foot, and passed into a chamber in that condition. One hundred cubic feet of air, we will suppose, contains 100 items of heat. It is obvious, therefore, that the single cubic foot into which the air has been compressed contains 100 items of heat. This air so compressed is forced in films through thin annular spaces provided by placing one small tube inside another slightly larger, and at the same time surrounded with a constant flow of cold water, so that the heat in the compressed air is conveyed through the copper tubes into the water which passed away from the tubes quite hot. By this means 99 of the 100 items of heat have left the compressed air, and when it is permitted to pass from the machine and resume its natural proportions, each cubic foot of air contains only a hundredth part of the heat it formerly did. Air of an ordinary summer temperature can quickly be reduced by this machine to a temperature of 30 degrees below zero. The cold air thus created passes from the machine into a large chamber just above the propeller shaft capable of holding 17,000 sheep. The air being originally drawn from this chamber and repeatedly re-extracted and returned to it, each time cooler than it was before, it is easy to conceive that a very low temperature can be maintained even in a large chamber. On the voyage south a temperature of ten degrees below zero was maintained in the empty chamber.

Special care has been taken in this vessel to make it serviceable to the nation in the event of war. The *Orient*, it may be remembered, was the first merchant steamer built to meet the requirements of the Admiralty for a war cruiser, and experience has shown that a vessel's strength and buoyancy have not been impaired by its fitness for adaptation as a war vessel. The Orient Company have in the case of the *Austral* extended the experiment far in excess of the Admiralty requirements. We have already spoken of the buoyancy of the vessel and the means at command for extracting water or extinguishing fire. One of the conditions laid down by the Admiralty as necessary to enable a merchant ship to be converted into a war cruiser is that there should be provision for protecting the vital parts of the vessel from injury. In all cases it is required that there should be a space around the engines and boilers above water-mark in which might be stowed some material to serve as an armour against projectiles. The *Austral* is so planned that for the protection of the engines there may be a bed of coals several feet deep surrounding them, and beyond this it is so arranged that bales of compressed wool may be so stowed as to provide armour for the whole hull of the ship.

In extension of the scheme of utilizing the mercantile marine for the purposes of naval defence, the Orient Company have recently acquired a couple of islands in the Chagos Archipelago, about the 7th degree south latitude, and almost exactly midway between Aden and Melbourne. One of these islands—Diego Garcia—has been provided with arrangements for storing coal by cession from the Mauritius Government, and it is proposed to have a service of lighters continually at work carrying coal from any convenient port to this station. The *Austral* is provided with sufficient coal to carry her straight from London to Australia, and it is proposed by the company, in the event of freights being light, to do so; but when freights are abundant they propose to coal only so far as will enable them to get to the island of Diego Garcia, and there coal for continuing the voyage. It has been felt that this coaling station will form an important link in the chain of defences between this country and the Antipodes. We believe that negotiations have already been commenced with the Admiralty respecting the terms upon which this coaling station would be placed at the service of the Government in the event of war. Thus, the Admiralty would not only have at their command ships of the *Austral* class, but accessories which would prove specially necessary for manipulating them as engines of war.

In the course of the complimentary remarks which usually follow successful trial trips, Mr. J. G. S. Anderson, on the part of the owners, expressed his high appreciation of the vessel, and specially complimented the builders. Mr. William Pearce, in responding, expressed his regret that the enterprise of such companies as the Orient was circumscribed by the civil engineers of the world, the capacity of whose docks and canals was now exhausted by the energy of the naval architects. He remarked also with surprise on the fact that the present managers of the Clyde, whose predecessors in the last generation had made the river what it is, should continue to permit obstructions to exist in the river, so that vessels of the *Austral* class required two tides to take them down.

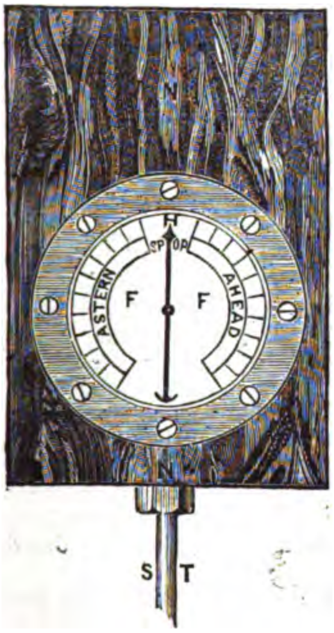
SHIP SHEATHING.

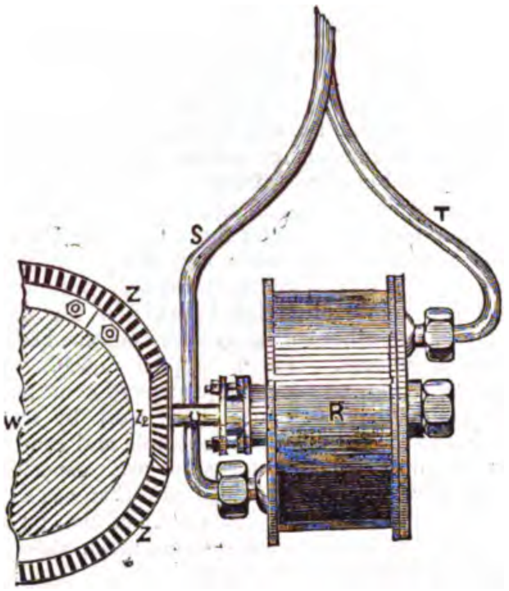
THE Patents of Messrs. Thomson & Co., 85, Gracechurch Street, specimens of which were shown at the late Naval Exhibition at the Agricultural Hall, are well worthy the serious attention of marine engineers. The problem has long been recognised as one of the greatest importance, and, stated in its simplest form, is "how to keep a ship's bottom clean?" An even and uniform surface is required, which will at the same time defy the attacks of barnacles, grasses, sullage, &c., which tend to accumulate in a manner that would astound the uninitiated. These excrescences slowly but surely retard the speed of the vessel, and loss of speed in vessels, and more especially in steamships, means increase of cost. The natural expensive results of docking, scraping, and re-coating at frequent intervals follow. The ordinary and best sheathing for wooden ships is copper. As was fully brought out by the investigations of the Non-Committee of the Institution of Naval Architects, the action of copper in keeping a ship clean is mechanical. They find that copper oxydises in parallel layers, and that it sheds off in very thin layers, so that the substances which cause the fouling of the ship, having attached themselves to the copper, lose their hold and fall off by the continual exfoliation of the copper. All other metals oxydise in irregular forms, and the foreign substances attach themselves to it firmly. This qualification renders copper invaluable for ship sheathing, but when the copper came to be applied to iron ships, it was found that galvanic action was set up. In fact the iron and copper formed a cell, or, more correctly, an element in a voltaic pile. The speedy destruction of the iron was the immediate result. Hence the problem resolves itself into a question of *insulation* between the iron hull and the copper sheathing. In Thomson's patent, the copper plates are attached to the vessel by means of a non-conducting alloy, the plate being coated with this alloy in a fluid state, is placed in position and under mere hand pressure speedily adheres with such tenacity, that hammer and chisel are required to remove it. The alloy being a non-conductor, insulation is practically complete, no electrical action being detected, and when the plates are removed the iron underneath is found as perfect as when the ship was first built.

Messrs. Thomson & Co. have also patented a "vitreous" or enamelled plate, to take the place of sheathing, and which is claimed as an improvement on the innumerable paints and compositions so largely employed as preservatives. With the vitreous plates the vessel may go for years, and can be cleaned with a mop and water at any time. We may remark incidentally, that these vitreous plates are now being very largely employed for roofing purposes, the sides of buildings, lining water tanks, and a variety of other objects, which will be found fully explained and illustrated by numerous designs and drawings in the handsome pamphlet issued by the patentees. We frequently see the simplest inventions develope into enterprises of world wide necessity.

KUHLMANN'S PATENT SPEED TIMER.

IN our last number, we gave illustrations of the Automatic Bridge Telegraph of Mr. A. H. Kuhlmann, 21, Great St. Helens, E.C. This apparatus, it will be remembered, replies automatically to the pilot or officer in charge, showing not only that the order has been received, but that it has been carried out, the reply pointer being connected with the way shaft. For use in connection with this, or independently, Mr. Kuhlmann has introduced a speed timer, illustrations of which we give in our present issue. The principle is similar to that of a steam gauge. Fig. 2, represents the engine-room apparatus, W is the engine shaft, Z bevel-gear actuating the axle, O, of a propeller, or fan, revolving in the box, R, which is filled with water mixed with glycerine. The motion of the propeller, according with that of the engine, transmits a varying pressure of water through the pipes, S, T, which communicate with the indicator, N, on the bridge. N is divided into two parts by a thin metal plate, which by the varying pressures of the water on the two sides, moves the pointer and indicates the rate of speed ahead or astern as the case may be. A tank placed above N automatically keeps R and the pipes, S, T, supplied with water, making good any accidental loss. This apparatus it will thus be seen is extremely simple. It performs a most important function by keeping the officer in command at all times informed of the speed at which the engines are running, and should on general grounds be welcomed as a genuine endeavour to make the deck and the engine room more thoroughly in accord. We are convinced many accidents are due to the want of thorough unity between the two departments; and this not owing to faults on the part of the captain, or on the part of the engineer, but to the absence of mechanical means of placing them in thorough accord. The old system was too much like a blind coachman holding the reins with a footman in the rumble directing him how to drive. That these days are past, is abundantly proved by the multiplication of inventions such as the present, for placing "the man on the bridge" in full cognizance and command of every department.





ELECTRIC SHIP'S BELL.

MESSRS. BINKO, SIEGEL & CO., 21, West Corridor, Crystal Palace, have produced an electric bell which seems destined to take the place of many others at present in the market. In the ordinary arrangement the armature is affixed to a spring; the coil, armature, and hammer are fastened on a wooden base-plate, covered by a wooden box, outside of which the bell is affixed. In the new method the armature works on pivots having a lever motion, whereby all vibration is avoided; the coil, armature, and hammer are fixed on a metal base beneath, and covered by the bell itself. The bell is screwed on a pillar rising from the centre of the base. By this arrangement the relative position of the parts is absolutely fixed, and the adjustment can never be disarranged by difference of temperature or moisture, as is the case with a large wooden base board. Space is economised in the ratio of one to four. The metal plate may be screwed in any position, or suspended to the end of the wire, or used as a letter weight, there being absolutely nothing exterior to the bell itself. These advantages, sufficiently important in all circumstances, are doubly so on board ship, where, however, we encounter a still more striking benefit. Vibration—and there is plenty of that on board ship—is fatal to the accurate working of the ordinary spring armature bell. The Lever Bell is absolutely unaffected by any vibration whatsoever; in fact, from its mechanical construction, it cannot be so affected. We could not easily explain the action without a drawing, but we have tested it thoroughly, and were much pleased with it.

Messrs. Binko, Siegel & Co. have also introduced a new form of carbon-manganese battery, which reduces this species of battery to its simplest elements. Putting on one side the outside jar and the acid, as common to all batteries, we find the well-known Leclanche to consist of five elements—zinc, carbon, porous pot, crushed manganese, and crushed carbon. The improved Leclanche, or agglomerate, contains zinc, carbon, and two manganese blocks, the latter three elements being held together by indiarubber bands, and the porous pot dispensed with. The new cell contains only two elements, zinc, and a combination block, wherein the carbon, manganese, and other substances are combined together by a special process. This is simplicity itself. There is no replenishing, no renewals (except, of course, of the zinc), clearing the block after hard work by scraping being alone necessary. Such a simple and everlasting battery is most valuable for ship use, especially as in case of need no other exciting liquid than sea water is required; and we have assured ourselves that no power is lost, the electro-motive force being much superior to that of a Leclanche of similar size.

THE AVALANCHE.

DESPITE its curiously-inappropriate name the Avalanche is a step in a right direction, a direction which wonderfully few patentees have trod. We really cannot help remarking what a pity it is that inventors should hamper their really valuable ideas by appellations and verbiage which simply mislead 999 men out of a thousand. We can understand it in the case of a quack medicine, or an unworkable toy, but when it is employed to designate an important scientific apparatus, destined for use in the most appalling human disasters, we fail to appreciate the advisability of it. This invention, filling a great want—nay, more, tending to supply an obvious and long-deplored necessity—establishes quite a powerful enough claim on our notice; strikes home with more than enough of force, when it appeals to us under its plain-spoken subsidiary title of the "Sea Messenger." Not only would many an aching heart be soothed into resignation, but many a valuable lesson might be learned and applied by marine engineers, were information received as to the how, when, and wherefore of the disappearances so painfully frequent.

It is astonishing that even yet there is no expedient in common use but the primitive bottle, bobbing hither and thither at the mercy of wind and waves, attracting no attention until perchance thrown high and dry on a friendly strand. Indeed, we have often been astonished that ships do not invariably carry carrier pigeons. It is true they might be unable to battle with fierce storms and lowering skies, but we should consider them invaluable in, for instance, the case of the breaking of the propellor shaft of an Atlantic Steamer. An accident such as happened lately in mid-channel would have been known on either shore in a few minutes by such simple means. "The Avalanche" is designed not only to carry messages, but to save papers and valuable property in the case of wreck or other disaster. The *desiderata* for such an apparatus are strength, durability, buoyancy, large carrying power, to be perfectly watertight, to be easily and quickly used, and by its appearance to attract attention wherever seen. These demands appear to be very fairly met in the Avalanche, and it certainly deserves an extensive trial. A twenty-four inch size will carry with safety a hundred pounds weight, it is strongly constructed, with great buoyancy, and bears a mast and flags, besides being painted with luminous paint for use at night.

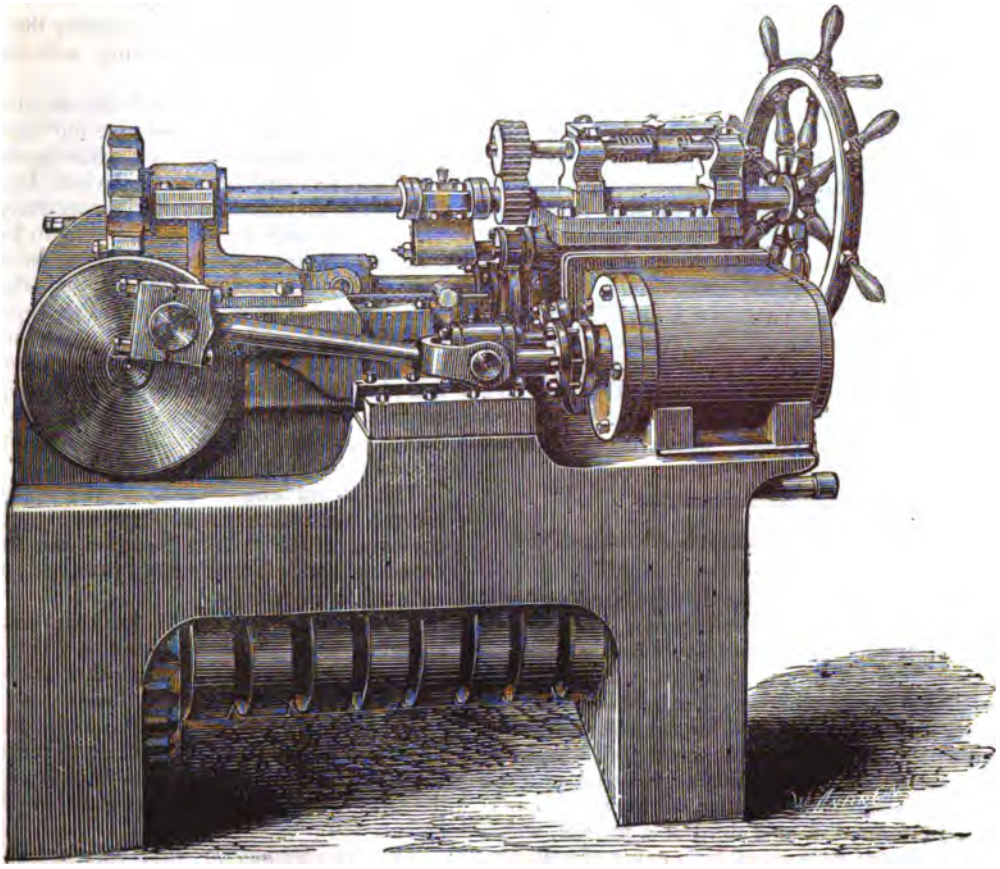
As we have said, the need of such an apparatus is undeniable, and all credit is therefore due to those who take the lead in supplying it. Full information can be obtained from the inventors, Messrs. Redknap & Penhey, Twickenham.

STEAM STEERING GEAR.

THE grand display of Steam Steering Gears at the recent Naval and Submarine Exhibition, bears eloquent testimony to the interest taken in this branch of Marine Engineering, and the rapid strides towards perfection that have been recently achieved by inventors and manufacturing firms. We illustrate, in our present issue, the apparatus of Messrs. G. D. Davis & Co., 669, Commercial-road, London. This gear is extremely well made and finished, has been approved by the experience of several sets now in actual use; the system exhibits a commendable simplicity and introduces a very ingenious, yet by no means complicated, arrangement of the screw hunting valve gear (as it is technically termed) which forms a prominent feature of this description of machinery.

The introduction of steam steering gear was sure to arouse the antiquated objections which periodically arise from their graves on any proposal to do by economic machinery what has hitherto always been accomplished by expensive human labour alone. To state the objections is to state the problems to be solved; but to state mechanical problems and dub them absurd or insoluble, is the sure way to rouse our engineers to action and to demonstrate forthwith that not one but many solutions exist. It is, no doubt, a difficult task—but as is now abundantly proved, far from an impossible one—to devise a steam apparatus to take the place of—or we should perhaps say, more correctly, work in intimate obedience and correspondence with—that most sensitive of all instruments, the human hand; with its combination of quickness, firmness, elasticity, its minutely accurate variability of power, as exhibited in the steersman. But the thing has been done.

A reference to our engraving will show clearly how the object is attained in the apparatus under notice. Beneath the iron frame on which the engine is placed will be observed the drum or barrel for the cable, one end of which bears a worm wheel. The latter gears into a worm (not shown in the drawing) on the crank shaft between the two disc eccentrics, driven directly by the connecting rods of the two cylinders. It is thus apparent how the admission of steam to the cylinder causes



DAVIS'S PATENT STEAM STEARING GEAR.

the winding of the cable in one direction or the other, and the consequent porting or starboarding of the helm. The admission of the steam is regulated by the hunting gear we proceed to describe, the problem being, to cause the action of the winding machinery to automatically cut off the steam as the work is done. The hand wheel is fitted on one end of a shaft, the other end of which is a screw, screwing into a screw nut forming the boss of a worm wheel gearing into the top of the large worm on the crank shaft, the boss running in a bearing as shown. The hand wheel shaft carries a cross-head between two collars, and attached to the valve rod. It is obvious that on turning the wheel, say from left to right, the shaft is screwed into the boss, drawing forward the collar and valve rod, and giving the steam admission to the cylinders. The revolution of the large worm on the crank, tends through the intermediary worm wheel to send the hand wheel shaft back again, carrying with it the collar and cutting off the steam. Of course the reverse action takes place when the hand wheel is turned from right to left. The pointer above works against stops to prevent the wheel being turned too far in either direction. It will be seen that this gear is very sensitive while the simplicity and general arrangement of the parts admit of great strength being employed in the construction. There is an auxiliary hand gear, not shown in the illustration, which can be used independently. Messrs. Davis fitted their machinery to the cable ships *Faraday* and *Hooper*, whereon—as on other vessels—they have given great satisfaction. We may add that extension buffer springs are generally placed between the chain connections to obviate the shocks, which might be injurious in a heavy sea to a rudder held too rigidly by the cable.

SHIPS' FLAGS.

A BRANCH of marine industry, the magnitude of which may be readily overlooked by the uninitiated, is that of supplying the varied descriptions of "bunting," which our ships and ports display so liberally. Many may think it easy enough to make a flag; but in truth, apart from the skill required to design and print the large numbers in use, the greatest care has to be exercised in the manufacture. Anyone who has seen a flag or ensign blown into ribands by a stiff breeze, will acknowledge the force of this. None of our flag-makers have gained a more secure footing in this trade than the firm of Messrs. Thomson & Son, 21, London Street, E.C., who made a brave show of "standards," "ensigns," "jacks," "house-flags," "signals," and every species of "bunting," at the late Naval Exhibition at the Agricultural Hall. This house have for the past eight years held the honourable appointment of sole flag-makers to the Admiralty, as well as principal makers to the war department, customs, and other Government offices, and to many Foreign Governments. The fact that every ship must carry ensign, jack, owner's house flag, and a set of signals, nineteen in number, while all these are made in no less than six sizes to suit vessels of different magnitude, and that this is, so to speak, but one leading line, will sufficiently indicate the magnitude of the trade, and its capacity for extension. By sound and artistic work, and by an accurate knowledge of what we may call the *heraldry* of the subject. Messrs. Thomson & Son have raised themselves to their present honourable position, and keep in the first rank. We may add they issue a very interesting and instructive paper on "Flags, Flag-making,' which is well worthy perusal.

DONOVAN'S BOAT-LOWERING APPARATUS,

A MODEL of which was exhibited at the late Naval and Submarine Exhibition, by the Patentee, Capt. Donovan, of West Hartlepool, is without doubt worthy of attention from those interested in the subject. Some of the advantages claimed are as follows : The boat once secured in the chocks, is *always ready* for launching without being lifted with the tackles. The speed with which the boat can be swung out of the chocks, lowered into the water and detached from the tackles, all of which operations can be performed in one third of a minute, which renders the apparatus very valuable in cases of collision, stranding, or of a man falling overboard. One man can swing the boat out ready for lowering. It is impossible to detach one tackle without at the same moment detaching the other one. There are no pins to look after on a dark night, and the apparatus is so simple that any ordinary person on board the ship could work it. In a former notice, which appeared in the MARINE ENGINEER, we expressed a doubt as to whether assistance could be rendered to the boat's crew from those on the ship, in hoisting the boat on board. On further acquaintance we find that the boat *can be* hoisted on board in the same manner as with ordinary tackle.

COLD AIR MACHINERY.

THE development of the frozen meat trade from Australia, New Zealand, and America, having made rapid progress during the past few years, as a consequence various types of refrigerating machinery used for bringing over the cargoes and storing them here, have been designed, and appeared for the market under the names of Bell, Coleman, Haslam, Hicks Hargreaves, Halls, Lightfoots, and Piggotts.

These machines have also lately taken an important place amongst the fittings of merchant steamers, for the purpose of doing away with the carrying of live stock —as now fitted to the s.s. *Clyde*, *Rome*, *Carthage*, *Sutley*, *Thames*, &c, of the Peninsular and Oriental Steam Navigation Company, as well as to other vessels
of different companies. They are used not onl
serving dead meats, but for all the ships provisi
as salt meats, fish, vegetables, cooling the drinki
and wine bins, besides making sufficient ice
passengers uses.

Messrs. Piggott's machine being the latest one
under public notice, we now give our readers th
of a detailed account of its construction, illust
which will be found on page 73, where Figs. 1 a
present the elevation and plan respectively.

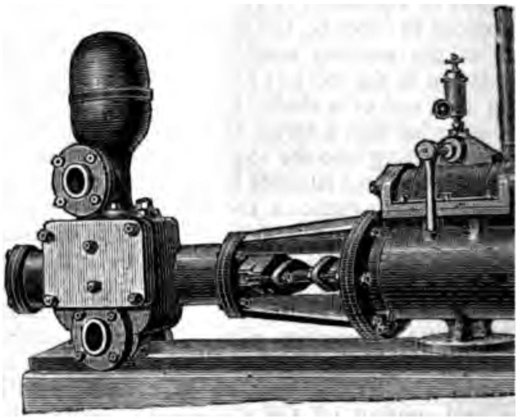
As will be seen from these, the main bed-pla
a steam cylinder with its condenser, an air con
and an air expansion cylinder, of which th
cylinder *A* and compressor *B* are in line on on
the bed-plate, while the expansion cylinder *C*
denser *D* are similarly placed on the opposite si
bed-plate, which is of a considerable depth, is
contain all the air passages leading to and
compressor and expansion cylinders, and so a
of unsightly pipes are dispensed with.

The steam engine part of the apparatus
pattern manufactured by Thomas Piggott & C
the name of the "Atlas" engine, the same p
crosshead guides, connecting rods, &c., is use
air expansion cylinder.

The connecting rods of the steam and air e
cylinder, are, as will be seen in Fig. 2, att
cranks at right angles to each other at the oppo
of the crank shaft, carrying a flywheel at its cen

The compression cylinder *B* is 11 inches diam
18 inches stroke, and consists of a cast-iron internal
shell, in which is fitted a brass liner forming the
the space between which and the shell forming
jacket.

The cylinder has no inlet valves, but the b
is perforated circumferentially at its centre for
of about 4 to 5 inches ; this portion being surrou
the inlet air passage in fig 2 on top of the cylin
The piston is very deep and of such a length
perforated portion of the liner is not uncove
near the end of each stroke.



ATLAS STEAM PUMP.

The advantage of the absence of inlet valv
it enables the whole of each end of the cylind
given up to the delivery valves, for which pur
end of the cylinder has a metal plate fitted
containing the seatings of the valves, equall
round the centre, each valve seat having a p

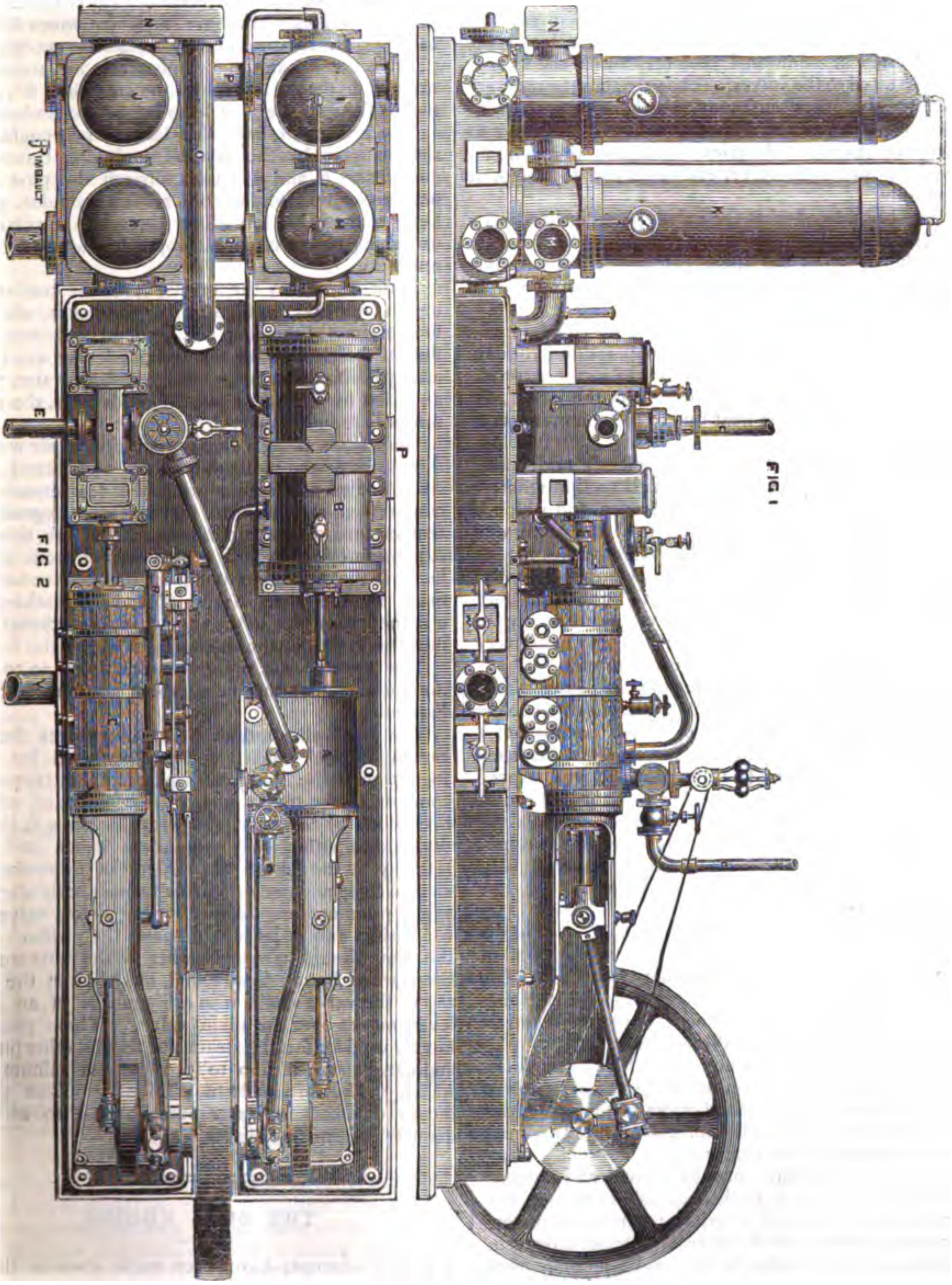


FIG 1
FIG 2
N
J
K
H
M
P
E
D
B
Y
RIMBAULT

PIGGOTT'S COLD AIR MACHINERY.

cylinder around it, cast in one with plate, and serving as a guide for the valve. This plate butts against the end of the liner and also bears against an india-rubber ring, by which the end of the liner is surrounded.

Between this plate and the cylinder covers is another rubber ring which serves to keep the plate in position while the valves are open, when they are closed, the plate receives an additional pressure due to the springs which are fitted to the valves. The valve has the ordinary mitre seat, the outer surface of which is prolonged, so as to work in the guides above mentioned and serve to contain the springs. A series of plugs in the cylinder covers, opposite each valve, enables them to be got at very readily.

It may be noticed that the valve plate itself forms a larger valve or yielding surface to the end of the cylinder, so that the stroke of the piston can be worked with but a very small amount of clearance, without any risk of damage.

As shown in figs 1 and 2, cocks are provided on the top and towards each end of the compression cylinder, which can be used as indicator cocks, lubricators, or for admitting water into the cylinder from the jacket, for assisting in taking up the heat due to the compression of the air.

From this description it will be clearly understood that during the earlier portion of each suction stroke a partial vacuum is formed in the cylinder, and which is increased until the piston has uncovered the perforated portion of the liner, when air immediately rushes in.

During the return stroke, of course a small amount of air is forced out again through the perforations, and until the piston again covers them, when compression proper begins. The total area of the perforations being very large, the filling of the cylinder is very prompt.

From the compression cylinder the air passes down and through the passages in the bed-plate to the coolers or condensers, *H, I, J, K,* each of which consists of a wrought-iron shell fitted to a cast-iron base, the shell containing a nest of bent U tubes, ferruled and brazed into the tube-plate at about the level of the bottom of the orifice, *M.* The compressed air passes through the tubes, while the cooling medium circulates in the opposite direction around them, a mid-feather in each condenser compelling the cooling medium to circulate throughout the whole length of the tubes.

In the two condensers, *H, I,* the cooling liquid is the water after having passed through the water-jacket of the compression cylinder in the other two, *J, K.* The cooling medium is the waste cold air from the chamber operated upon, which arrangement does not form an inherent part of the action of the machine.

During the passage of the compressed air through the condensers the greater portion of the aqueous vapour is condensed, thrown down in the bottom of the condenser base, in the side at which the air passes out, and from whence it is automatically drained off.

To further intercept this aqueous vapour, and prevent its being carried forward to the expansion cylinder, the air is made to pass through a series of perforated plates, which appear to strain off the finer particles of moisture. The arrangement is evidently successful, judging from the small amount of snow formed in the expansion cyclinder.

From the last condenser *K,* the air passes away through the bed plate to the expansion cylinder *C.*

This cylinder is 8 inches diameter and 18 inches stroke, and provided with a variable cut-off gear, shown in Fig. 2; and on the coilless principle, the valves and ports being at the bottom, any water or heavy substance is thoroughly got rid of. The cylindrical chamber in which the main valves work have their entrances fitted with the cut-off valves, worked by a separate eccentric.

From the expansion cylinder, the air, cooled by its expansion, passes down into the snow box *W,* and from thence through the pipe *V* to the cold chamber.

The return air from the chamber is brought back to the machine by the pipe *M,* and after traversing the condensers *K* and *J,* passes through the pipe *N* to the passage leading to the compression cylinder, provision being made in the box *N,* by means of a circular grating, for taking in any required proportion of fresh with the return air.

With regard to the efficiency of the condensers, we understand that during a trial at the works, while the air temperature of the shop was 55 deg., cold room 28 deg., that of the air entering the first condenser was 145 deg.; after passing through the two cooled by water, 72 deg.; and after traversing the two air condensers, the temperature was reduced to 65 deg.

On this occasion, a large proportion of air was drawn direct from the workshop. We understand that the water cooled condensers bring the temperature of the compressed air down to within three degrees of the temperature of the cooling water. At the side of the expansion cylinder, and worked direct from its crosshead, is the circulating pump *R,* the connections being made by the pipes *S* and *T,* and the discharge at *U.* *a* is the steam pipe to the engine; *b,* the exhaust; *d,* the injection; and *E,* the discharge pipe into the hot well.

The working air pressure varies from 30 to 45 lbs., the final temperature being about 20 to 26 below zero, Fahrenheit.

The small illustration, p. 72, represents the "Atlas Steam Pump," and has been designed by Messrs. Piggott with the view of dispensing with tappet valves common to the special and other pumps, and which has been done by means of two movable rings in the cylinder, one at either end, which are struck and moved laterally by the piston at each end of its strokes, these rings closing and unclosing small steam ports alternately, which ports communicate with the piston valve in the top casing, and in its turn actuates the piston. In case the pump should be stopped when all the ports are closed, the starting handle is attached, as shown at the side on top of the valve chest, which, by means of an internal lever, moves over the main valve. These pumps are largely used for feeding steam boilers and other purposes, and can be run at 200 to 300 feet per minute piston speed. They are made in various sizes from 2½ to 10 inches diameter of water pump, and 4 to 26 inches diameter of steam cylinder.

THE DUAL ENGINE.

MANY attempts have been made towards the successful introduction of the dual screw. The dual screw is not a twin screw, but consists of right and left-handed propellers driven in opposite directions on concentric shafts. Such an arrangement was indeed patented by Sir F. P. Smith, very shortly after his invention of the single screw, and the advantages are very great. Thus, experiments prove that right and left-handed propellers of 15 inch diameter, driven at 130 revolutions, are superior to a single propeller of 2 feet diameter, making 250 revolutions, while the vessel can be stopped in half the time. We find, hence, that a vessel of 8 feet draught can be propelled as quickly as one of 12 feet with an ordinary screw, making the dual screw invaluable for shallow draughts, and all towing and canal purposes. Further the throw of the water being in the direct line of the keel, there is no oblique impact on the rudder, which conduces to perfect steering, overcomes the liability of the vessel to sheer to one side or the other when suddenly stopped and the engines reversed. The yacht *Dua* fitted with 16 inch horizontal surface condensing engines on this principle, has steamed from Dungeness to Dover Admiralty Pier, (17 miles), in moderately fine weather, entirely unaided by the controlling action of her rudder.

All or most of the proposed methods of practically carrying out this idea, have, however, involved the use of gear or belting, to get the reverse motions; this was of course fatal to speed, more particularly in marine engines. Messrs. Mackenzie and Vivian have in their dual engine introduced a very ingenious and apparently effective method of working both shafts from cranks direct from the piston stroke, which will be readily understood from the very clear illustrations we furnish. Figs. 3 and 4 give general views of the engine from in front and behind, Figs. 1 and 2 (which are merely explanatory, and not to scale) are vertical sections through, and at right angles respectively to the shafts; Figs. 11, 12, 13, 14, illustrate the revolution of a crank round the shaft.

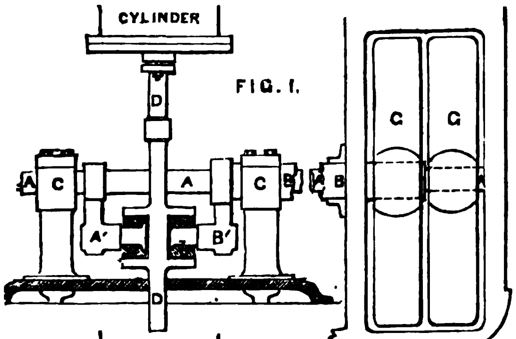


FIG. 1.

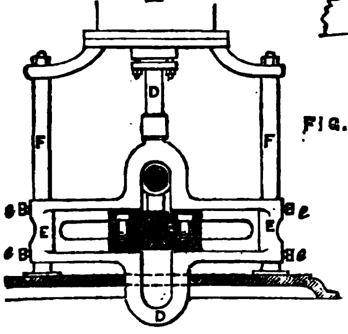


FIG. 2.

The most striking feature is the looped or bigurcated crosshead piston rod, carrying two slot blocks bearing the pins of the cranks, which are attached respectively to the male and female shafts. The drawings show most plainly the mode in which the cranks are thrown completely round the shafts at each stroke, and also how this is done in opposite directions. *AA* is the male or inner shaft, *BB* the female or outer, *GG* the propellers. *DD* is the looped and slotted crosshead working in the guides *FF* which support the cylinder. A^1 B^1 are the crank pins, *a b* the slot blocks for the shafts *A* and *B* respectively. In Figs. 11-14 the dotted line is a fixed horizontal, and *A* a fixed point, and sketches show in four consecutive positions how the slot-block *a* is carried round *A*, causing the shaft to revolve. A reference to Figs. 3 and 4 tells at a glance how the rotations are in opposite directions.

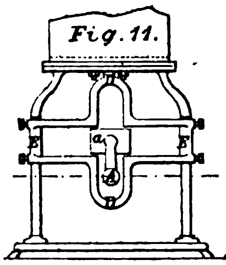


Fig. 11.

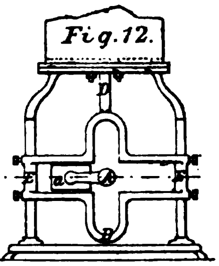


Fig. 12.

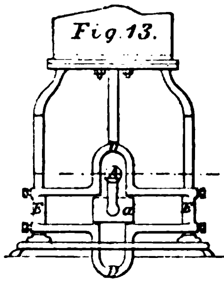


Fig. 13.

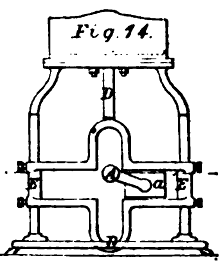


Fig. 14.

This arrangement exhibits both cranks driven by these slotblocks; but it is equally possible—indeed, for larger vessels, is preferred—while working the female shaft by the looped crosshead, to drive the male by the ordinary connecting-rod or a common slotblock. Although the chief use of the Dual system has been for marine propulsion, the inventors consider the plan applicable to many other uses, as pumping, laying cord or wire uniformly over telegraph cable, and crushing or grinding mills. The invention, being as simple as ingenious, is well worth the attention of marine engineers.

FLEXIBLE COUPLINGS FOR SHAFTS.

THIS coupling, which we only had space enough to briefly notice in our last number (p. 51), and which was shown in action at the Naval and Submarine Exhibition of last month, being of a very novel design, and having a large range of applications, we deem it worthy to bring before our readers again.

The occasional recurrence of disasters at sea to screw steamers, in consequence of derangement or breakage of their main shafts, is no doubt unfortunately familiar to most persons.

At the present time the construction of iron vessels is made more with regard to high speed than large carrying powers, and for the attainment of which they are made of great length and narrow beam. This necessitates the propeller-shafts being extra long, and so more liable to injury if any undue external strain should be brought to bear upon them.

Now that so large a proportion of the carrying trade to all parts of the world—whether of passengers, mails, or most valuable cargo—is made by screw steamers in preference to sailing vessels, on account of the vast amount of time saved, it behoves all steamship owners to prevent, as far as possible, any breakdowns, and remedy any known defects in the construction of the machinery that skill and ingenuity can accomplish.

Some of the chief causes of failure are, no doubt, faulty material, and racing of the engines in rough weather; but also a serious source of evil is the effect caused in the hulls and framework of the vessels by the striking of heavy cross seas: the shaft, being a heavy rigid mass, cannot partake of any lateral local movements of the framework to which it is attached, hence a great amount of side spring is brought into play, as well as jambing it in its bearings, and which may result in causing fracture. It is with the object of removing this last-mentioned danger that Mr. Arthur Verity, of Leeds, is introducing this coupling to the maritime world.

EXHIBITS AT THE SECOND FURNITURE TRADES' EXHIBITION.

AMONGST the exhibits at the Second Furniture Trades' Exhibition, at the Agricultural Hall, London, were some not without interest to ship builders and owners.

MESSRS. G. D. PETERS & Co., Moorfields, London, who are well known specialists for railway carriage and steamship saloon fittings, while ready to upholster ships throughout with their own workmen, supply a large variety of the various necessaries, many of which are their own patents. We may mention their bed, berth, and seat spring, which is healthful in principle, and perfect in comfort, proof against all dust and vermin, and a complete preventive from infectious diseases. While these qualities are always commendable, they are specially so on board ship, where there is more risk and less ability to cope with it. The patent automatic blind for saloons of steamers, yacht cabins, &c., is the perfection of simplicity. Blinds not working, or always getting out of order, are one of those worrying little troubles that are sure to put people into a bad humour; and there is no excuse when the difficulty can be so easily obviated. Pope's Patent Lighting and Heating System, has now been adopted by the principal companies, its illuminating power being more than four times, and its cost about one-fourth, that of oil lamps. Without taking into account its immense economy, this system offers other important advantages, viz: immunity from breakages, and cleanliness and efficiency in working.

THE STOWE BED MANUFACTORY, 2 Coleman Street, E.C., have a very simple lathe spring berth, both convenient and comfortable, especially in hot climates.

MESSRS BARNBY & Co., Bull Street, Birmingham, have a patent combined folding and adjustable couch and arm chair, most simple in its adjustment, and durable in manufacture. For a deck chair or lounge we should highly recommend it for its portability and ease.

MESSRS. JAMES LYLE & Co., 57, Bishopsgate Street Within, E.C., are specialists in the manufacture of folding furniture. Mr. James Lyle has for many years held a premier position as a naval cabinet maker, and has, therefore, had great experience in manœuvring against the exigencies of space and motion. The firm will make any article of furniture to fold up, and have even been called on to construct pianos in this way. They have, naturally, always in stock a great variety of folding chairs, book shelves, &c., but their strongest line is in their tables, not only small round folding tables, but dining tables of large size. Dining tables made on this new principle will fold when not required for use into a space of from 5 to 6 inches by the length and width of the top, without the use of bolts, screws, or any other fastening whatever, the process being entirely automatic, and dispensing with all loose parts; on board ship they are found invaluable, as they can be taken on deck or put to one side with the greatest ease. These tables are made in all sizes and styles to suit the variety of wants and tastes; and, we need hardly add, are thoroughly well made of carefully-selected wood. Indeed, Messrs. Lyle pride themselves on their makes of furniture of all kinds to stand the test of extreme climates.

Not merely an inconvenience, but a potent source of danger is removed by the use of Hawksley's Patent Treads, owned by Mr. J. WESTWOOD, JUNR., 39, Great Tower Street, E.C. These have long been well known and extensively employed for their durability, simplicity, firm footing, elasticity, and noiselessness; they excel lead, oak, teak or stone, and are applicable to wood or iron, spiral, or other staircases. For gangways, companions, saloon staircases, &c., they are simply invaluable. Their application is simple, and they are almost everlasting. With an estimated traffic of over 6½ million persons in three years, the steps in the centre staircase of Dalston Station did not wear down from their original surface more than one-sixteenth of an inch.

MR. EDGAR ALDOUS, 18, Queen's Road, Peckham, S.E., has patented a hot and foul air extractor which he has applied to all purposes of ship ventilation. His arrangement is not only inexpensive in first cost, but cheap to use; as the head and all other parts being fixtures, there is no friction and therefore no wear. The essential principle is that of a down draught converted into an up current. The inventor claims his exhaust to be the first and only one constructed on this basis, and the most effective extant.

THE SANITARY PAINT COMPANY, 34 Leadenhall Street, MESSRS. GRIFFITHS, BERDOE, & Co., exhibit samples of their ships' paints. These include an anti-fouling paint for protecting iron and wooden ships from corrosion and decay, and effectually preventing fouling; a marine paint, ready for use in all colours, for all submerged iron and wood work, thoroughly protecting the iron of salt and sugar carrying ships; and a funnel paint which does not blister or scale off. These paints are unaffected by extremes of temperature, and retain their good appearance until the last.

THE INDESTRUCTIBLE PAINT COMPANY, LIMITED, 27, Cannon Street, have a handsome stand with samples

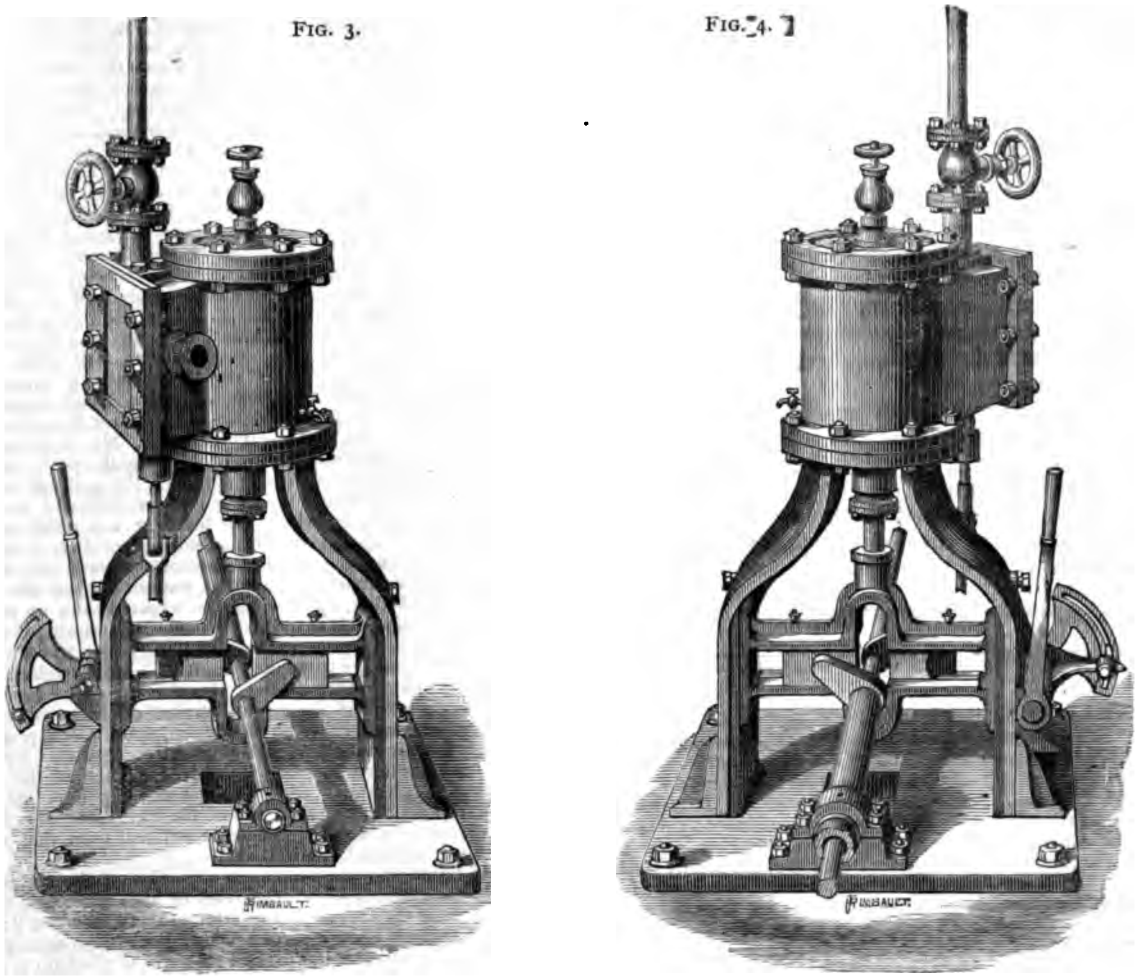


FIG. 3. FIG. 4.

MESSRS. MACKENZIE & VIVIAN'S DUAL ENGINE. (*For description see pages* 74 *and* 75).

of their manufactures and surface to which it has been applied. The Enamel Paint and the Indestructible Paint are too well known to require any general laudation from us, but we are interested to note the success of their application on board ship, as proved by many valuable testimonials.

COMBINATION STEAM WINDLASS.

THE illustration (page 79) represents one of Emerson, Walker & Co.'s patent horizontal direct steam windlass, which are so very largely in use in H.M. Navy and the merchant service, as the model shown at the late Exhibition testified, it being marked No. 5,600.

The machine has both steam and hand power, the latter being actuated by lever handles having a pump motion.

The two steam cylinders are horizontal, and so prevent all vibrations of the deck, and being inside the frames, have not only a very snug appearance, but prevent in a great measure lateral oscillation of the frame, besides giving all the working parts facility of access.

The motions of starting, stopping, and reversing are effected by one single lever, so necessitating only one man to work the machine, who can thus perform all the necessary manœuvres with rapidity and ease.

The power is transmitted from the gearing to the lifter through a large brass frictional cone, and which is put in and out of gear by a brass nut.

This cone and nut also act as a powerful brake, and by which even one or two links can be given at a time, and the cables let go, veered away, or brought up.

The holding power is very effective and complete, each lifter having its own pawl distinct from the purchase, thus preventing the possibility of the cable slipping when heaving in, while it acts as a powerful adjunct to the bow-stopper when riding at anchor.

The whole of the work is very strong and well fitted in a bed-plate, all the working parts carefully adjusted, in order to reduce the wear and tear to a minimum.

The windlass can also be arranged with a warping capstan on same deck or on forecastle, connected with it and driven through it, by steam, in the *Furnessia* and *Belgravia* of the "Anchor Line" it has been specially fitted with two steam warping capstans on the Turtle Deck.

We are informed that over 5,000 ships of various nations have been fitted up with these machines (either direct-acting driven by messenger chains from steam winch, or worked by hand power simply) and comprising the principal steamship companies at home and abroad, and some of the largest vessels afloat, also many steam yachts, the two latest additions being Sir Thomas Brassey's *Sunbeam*, and the Marquis of Londonderry's *Cornelia*.

The various types of windlasses that Messrs. Emerson & Walker manufacture are specially designed for all classes of ships and yachts, and it is worthy of mention that at a recent exhibition of machinery at Birkenhead a silver medal was awarded them for the machines above illustrated, the gentlemen who formed the committee of judges, giving as their opinion, it was admirably adapted for its purpose.

At the recent Naval and Submarine Exhibition, one of these windlasses was shown in action and attracted much attention.

In conclusion, we may remark that the first steam windlass made by Messrs. Emerson & Walker in 1857 is still satisfactorily at work, which speaks highly for the workmanship.

THE EDDYSTONE LIGHTHOUSE.

THE ceremony of lighting up the new Eddystone lighthouse was successfully accomplished on May 18th under the most favourable possible conditions. The Duke of Edinburgh left Paddington by special train at 4 a.m., and reached Plymouth shortly before 10 a.m. His Royal Highness then embarked on board the Trinity yacht *Galatea*, and proceeded to the Lighthouse, accompanied by Admiral Sir Richard Collinson, Captain Atkins, Mr. Douglass, sen., Mr. Douglass, jun., and some of the Elder Brethren of the Trinity House. The Mayor and Corporation of Plymouth were conveyed in the *Harpy* and *Perseverance*, the Devonport Town Council in the *Trusty*, and the Stonehouse Local Board in the *Carron*. The *Sir Walter Raleigh* and the *Sir Francis Drake* steamers took out large parties of excursionists; and the members of the Corinthian yacht club sailed out in their yachts. The *Galatea* was attended by the men-of-war stationed at Plymouth. The ceremony had the advantages of a quiet sea and a cloudless sky. On reaching the lighthouse, His Royal Highness minutely inspected the building, and then, after a prayer from the Rev. Dr. Wilkinson, lighted the lamps and declared the building open, afterwards recording the fact in the visitors' book at the lighthouse.

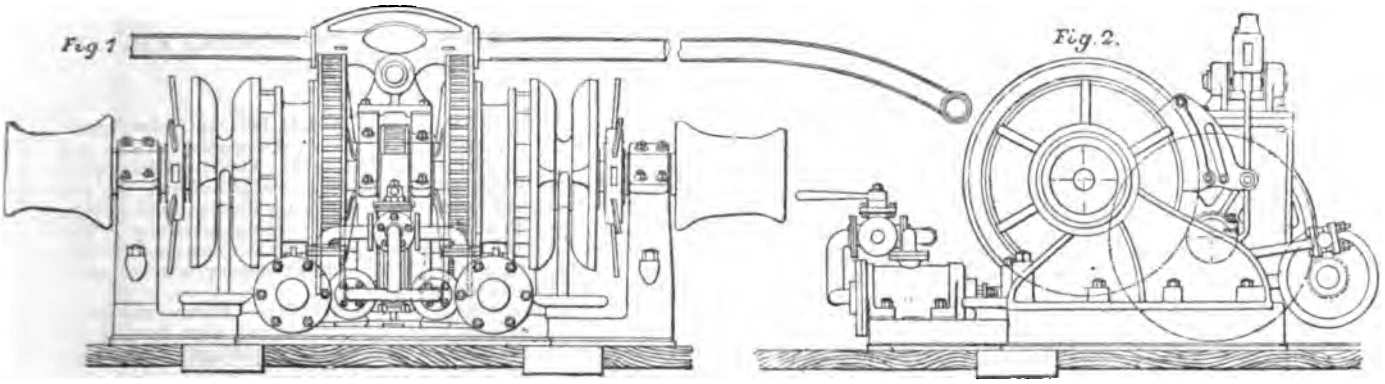
The new Eddystone lighthouse, forms one of the most important links in the chain of lights by which the coast of Great Britain is surrounded. So important is it that, when Smeaton's Lighthouse was condemned as unsafe, a proposal to remove the Eddystone reef by blasting was rejected, not only on account of the difficulty and costliness of the undertaking, but also because the fact of its presence, as affording a secure basis for a light, was held to be of value to navigation. The Elder Brethren of the Trinity House stated that "the use of the light is by no means confined to warning against an isolated danger with whose removal its function would cease; but the existence of that danger, in affording a platform for the exhibition of a light, has become not merely the means of giving a good lead into Plymouth, but of determining position and of providing an essential link in that chain of passing general lights which, as defining a straight course up and down the English Channel, and so avoiding the delay or danger attending deviation, may be regarded in these days of steam navigation and rapid maritime operations as invaluable."

The first Eddystone Lighthouse was built by Henry Winstanley, in 1696. It was constructed of wood and stone, and was carried away, together with the architect and keepers, by a violent storm in November 1703. A second, of similar construction, was built, in 1708, by John Rudyard, a silkmercer, of London, and this was burnt down in 1755. It was the property of shareholders, who held a lease of the reef from the Trinity-house. Of this lease more than fifty years were unexpired; and the shareholders, acting under the advice of the Earl of Macclesfield, the then President of the Royal Society, applied to John Smeaton to reconstruct the building. With commendable public spirit, they determined upon having the new lighthouse built in the best possible way, without regard to cost or probable profit; and the result of their liberality was the tower which rendered Smeaton's name immortal, and which has itself endured to the present time. For some years, however, this tower has been subject to tremors of an alarming character; and a careful inspection was made in 1877 by Sir Richard Collinson, the Deputy-master, and the Elder Brethren of the Trinity-house, accompanied by their engineer, Mr. Douglass, discovered that the rocky foundation had been undermined by the waves, and that, although the tower itself was sound, the portion of the reef upon which it rested had become insecure. The construction of a new lighthouse had therefore become imperatively necessary; and Mr. Douglass, who had already built several lighthouses, notably those on the Wolf Rock, off the Land's End, and on the Bishop's Rock, off Scilly, and who was also the son of a lighthouse builder of eminence, determined to take advantage of the opportunity to bring to bear all the resources of modern engineering, and to construct a lighthouse which should surpass that of Smeaton as much as Smeaton's had surpassed those by which it had been preceded. Several years ago, Mr. Douglass and his father were imprisoned in Smeaton's Lighthouse for several days, during which no boat could approach the reef, and he had therefore enjoyed peculiarly favourable opportunities of studying the nature of the forces which the building was called upon to resist. From this experience, and from subsequent study, he arrived at the conclusion that the shape of Smeaton's tower, which tapered upwards in a curve from the foundation, was not the best that could be designed, and that, by allowing the waves to run up readily towards the summit, this shape had the effect of throwing the main stress of the water upon the upper part of the tower, where it acted with enormous leverage to weaken the base. Mr. Douglass, in his designs for the new lighthouse, had therefore to devise means for diminishing the effect of the upward strokes of the waves, and of giving increased strength to the foundation, upon which, probably, a relatively greater amount of shock would be thrown. For this purpose he determined to place the curved portion of the tower upon a base with vertical sides, which would not have the same tendency to produce an upward run of the waves, and also to lay the foundation in a manner somewhat different from that which Smeaton had employed.

The old lighthouse was built upon a portion of the reef which, in ordinary weather, is just at the level of high water, and which affords no more than room for the structure placed upon it; but the new one stands upon a portion which is entirely submerged at high water, and which is the summit of a sort of platform of rock, slightly convex in its general form, and thus having a somewhat broad base at a level lower than its central part. In central part an excavation was made to receive the foundation, and the stones of the lowest course were bolted to the rock by bars of yellow metal, which passed into the solid gneiss below to a considerable depth, and were made to expand beneath by being driven home upon wedges. The lower part of the new building consists of a cylindrical tower, 44 feet in diameter and 22 feet high, which has its upper surface 2 feet 6 inches above the high water of spring tides. At the top of this tower is a landing platform, 4 feet 3 inches wide, which serves also as a promenade for the keepers in fine weather; and from this platform springs the base of the tapering tower, which is 35 feet 6 inches in diameter at its base and 18 feet 6 inches in diameter under the cornice, the top of which is 138 feet above the rock. The cylindrical portion is solid, and the tapering portion, with the exception of a water tank, is solid to a height of 25 feet 6 inches above the high water of spring tides. At this level the walls are 8 feet 6 inches thick, diminishing to 2 feet 3 inches at the top. The tower contains a sort of entrance-hall and eight rooms above it, in addition to the lantern, the seven uppermost rooms being 14 feet in diameter.

The tower is built wholly of granite, obtained from the De Lank Quarries, near Bodmin; and the great expedition with which the work has been completed, much within the expected time, has been mainly due to the manner in which Messrs. Shearer & Smith, the owners of the quarries, have carried out their part of the undertaking. The tower has, in fact, been constructed at De Lank, every stone having been finished there and marked for the place it was to occupy. The blocks of the lowest, or cylindrical portion, are each 6 feet 6 inches deep, 2 feet thick, and 3 feet 10 inches on their outer circumference, and they are all without a flaw. Throughout the whole tower every stone is dovetailed, by projections and grooves, into those above, below, and on either side of it; and the interstices between the blocks have been filled up with Portland cement, which blends the whole into a mass, the joints of which are as hard as the granite itself.

The mode of lighting of the new house has presented questions which have required the most careful consideration. On account of the distance from Plymouth, and of the practical impossibility of erecting machinery of any kind upon the reef, both gas and electricity were of necessity abandoned, and lamps burning colza or rape oil have been adopted. For the main light these lamps are two in number, one above the other, each having six concentric wicks, and giving an illumination equal to that of 722 standard candles. The two lamps are placed one 6 feet 6 inches above the other, and the intention is that in clear weather one only, and in thick weather both are to be used. The elevation of the light is 130 feet above high water instead of 72 feet as in Smeaton's lantern, and the range will thus be increased from 14 to about 17½ nautical miles, so as just to overlap the range of the new electrical lights at the Lizard. The character of the light is also to be changed, and the Eddystone is for the future to give a white double-flashing half-minute light, showing two successive flashes of two and a half seconds' duration, divided by an eclipse of about four seconds, the second flash being followed by an eclipse of about 21 seconds. A white subsidiary light will also be shown from a window in the lighthouse below the flashing light to mark the hand deeps. This will extend over a sector of 16 deg. from N., 32 deg. W. to N. 48 deg. W. A large bell will be sounded during foggy weather twice in quick succession every half-minute, thus assimilating the character of the sound signal to that of the light. The bells for this purpose are two in number. They are suspended just at the level of the cornice, and are to be worked in time of need by the same clockwork which ordinarily provides for the revolutions of the lantern. The upper part of Smeaton's tower is to be taken down and rebuilt upon the Hoe at Plymouth, the stump alone remaining upon its original place on the reef. The diminished leverage which this stump will offer to the waves may encourage the hope that it will long remain in safety.



MESSRS. EMERSON & WALKER'S COMBINATION STEAM WINDLASS.

(*For description see page* 77.)

PRIESTMAN'S DREDGER AND EXCAVATOR.

To those interested in the dredging of docks or the removal of obstructions, and accumulation of mud, and deposit in rivers, harbours, or canals, it will no doubt be of interest to know what improvements have been made of late years in the machinery connected therewith.

Messrs. Priestman Bros., of Hull and Queen Victoria Street, the well-known manufacturers of dredging plant, have lately brought under the notice of contractors and engineers a new form of double dredger, and which we illustrate on page 81.

Its chief novelty is that it can be applied to any existing barge to which a crane can be attached; the mud being deposited in the usual way into hoppers brought alongside, which thus makes a cheap and efficient dredger for dock or canal use.

The scoops are made in several different forms, according to the nature of the material to be operated upon. The illustation shows two forms.

For dredging soft materials such as mud and silt the bucket is made entirely of plate iron, and forming, when shut, a portion of a cylinder closed both ends. For shingle, the bucket is altered to the form of a grab with strong well-tempered steel fingers or tines (similar to a fork) set close together, and fitted with a strong wrought iron frame. A still stronger and more powerful kind is made for dredging blasted rocks and exceptional hard materials, which so dispenses with the use of divers for removing the débris.

In all cases the side frames and shafts of buckets are made of wrought iron, with cast iron drums for regulating the chains and opening and closing the jaws.

If required for sinking bridge pier-cylinders, the buckets can be made hemispherical.

Messrs. Priestman Bros. make special engines and cranes, of a strong and substantial character, for working these machines; the former have two cylinders attached to strong side frames, and work the lifting barrels direct, and so designed for working the self-acting bucket or grab at a high speed. The engine is attached to a massive cast-iron foundation, with wrought-iron pillars securely fastened in the centre.

The crane jibs are of wrought iron, and fitted with cast-iron rollers, bearing on the roller-paths in the centre of the foundation.

The boilers stand on wrought-iron hot-water feed tanks, and are of the vertical type.

The chains that work the buckets or grabs are capable of manipulating with accuracy at a depth of 25 ft. below water, and, if necessary, can do so at a much greater depth.

This dredging apparatus is equally applicable to discharging grain from ships' holds, each machine only requiring the attention of one man, and is capable of treating 60 ton per hour, which amount is about equal to the average working of what is called an American 100-ton elevator.

This dredging plant has been ordered by several Governments and dock companies, and we have no doubt it would prove a cheap and efficient tool for removing accumulations and obstructions in rivers, docks, canals, &c.

STEAM LAUNCH BOILERS.

IT having long been felt that a compact, efficient, and easily accessible boiler was required for use on launches, tugs, gigs, &c., Messrs. Cochran & Co., of Birkenhead, are now manufacturing their Patent Vertical Boilers, of the Horizontal Flue Tube type, in such a form as to exactly meet the above requirements, and at the same time to do away with the disadvantages inherent to the ordinary horizontal type of return-flue boilers, viz., relative large amount of deck space occupied, which not only lessens the carrying power of the vessel, but indirectly raises the centre of gravity of it.

These boilers are so constructed as to give a large amount of good and efficient heating surface in a small compass, and great facilities for getting at the interior parts for cleaning and repairs.

The construction of the boiler is as follows :—

The shell is vertical, with a segmental top, in which is placed the dome, but which is not an absolute necessity to the boiler.

The fire-grate is at the bottom, supported by a wrought-iron angle ledge. The furnace top is nearly hemispherical, with an orifice in it, immediately opposite the furnace door, and which communicates with the combustion chamber above it. This chamber, being formed on the top, and one side, by the tube plate, which is in the form of a ꓶ, and riveted to the shell—the other side is formed by a loose plate lined with fire-brick, forming, when in place, a part of the outer shell of the boiler.

The tubes run horizontally over the furnace crown, and are fastened in the usual way.

From the front of the boiler, and above the fire door, projects the smoke box, so that the tubes can be made as long as possible to the top of the smoke box which project, at right angles to the boiler is the chimney, the exhaust steam being taken in at the bottom, and carried up to within a few inches of the bottom of the uptake, in a similar manner to that carried out in locomotives.

The smoke box has two doors hung at a double angle, so that when the buttons are released they open themselves.

The construction of the boilers has also the advantage that stays are not required except across the combustion chamber.

The furnace crown being hemispherical has the advantage of exposing its surface everywhere at right angles to the flame impringing on it, and which is well known to be the best possible position for the absorption and transmission of heat.

Wood and inferior qualities of coal can be burnt with good result.

To give an idea of the large heating surface obtainable with these forms of boilers, we may state that with diameters of 3 feet 6 inches and 7 feet, heating surfaces of 40 and 120 square feet respectively are obtainable.

The sketch that we give, p. 83, is a longitudinal section of s.s. *Abeza*, showing the application of Messrs. Cochran's boilers to a launch.

This vessel was built for the Pacific Steam Navigation Co., for use at Valparaiso. Her dimensions are 45 feet keel, 10 feet beam, and 6 feet 6 inches deep.

Her construction is most substantial, the frames have all reverse bars and deep floors, the deck being iron.

The engine is a single cylinder one, 9 inches diameter by 9 inches stroke, working pressure 100 lbs., and makes 200 revolutions per minute. The propeller is 3 bladed, 3 feet diameter, and 5 feet 6 inches pitch.

The thrust block is brass and lignum vitæ.

It will be noticed that the space the boiler occupies is very small, and also that the bottom being simply an ash pit, any corrosion that takes place there will in no way impair the durability of the boiler.

The boiler is 4 feet 4 inches diameter, and has 80 tubes 1¾ inches by 2 feet 9 inches. At the trial trip 8½ knots was attained.

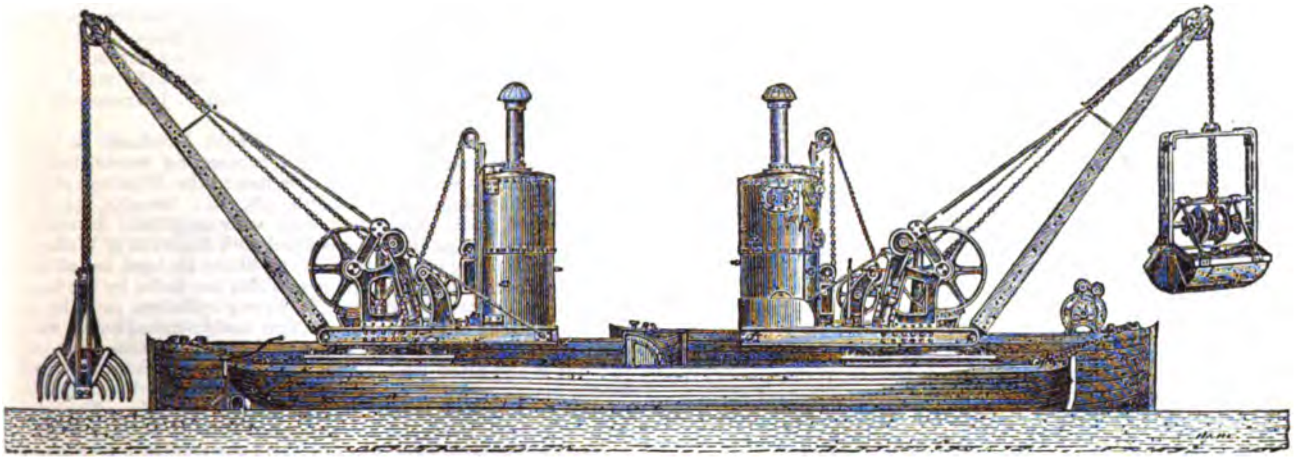
THE SHIPWRIGHTS' COMPANY'S EXHIBITION.

THE International Exhibition of Models, held at Fishmongers' Hall by the Shipwrights' Company, was opened on the 2nd May by H.R.H. the Duke of Edinburgh. This Exhibition quite comes up to anticipations. It was greatly admired by the numerous company, which included many distinguished foreign representatives, that attended at the opening ceremony. The success of the Exhibition is mainly due to the exertions of Mr. A. D. Lewis, warden of the Shipwright's Company, who has acted throughout as honorary secretary.

There were altogether nearly 400 models of different classes in the Exhibition, and out of these about 120 had been entered for competition for the medals offered by the Shipwright's Company.

In the war-ship section, although there are many exhibits, only three are entered as competitive. One is put in on behalf of Mr. A. Krupp, of Essen, and is a twin-screw steel gun vessel or cruiser armed with two of Mr. Krupp's patent central pivot 15-centimetre guns. She is 160 feet in length, 23 feet in extreme breath, and 12 feet 6 inches in depth from underside of upper deck to top of keel. Her load draught of water is 10 feet, and displacement 380 tons, and she is expected to be capable of steaming at from 17 to 18 knots per hour with an indicated horse power of 1,100 to 1,200. The other two are beautiful models of Messrs. Yarrow & Co.'s torpedo boats, one of which represents a boat built for the Italian Government which obtained a speed on trial of 25¾ statute miles per hour.

The other models of vessels of this class which were exhibited were not entered for competition. These include H.M.S. *Monarch*, *Devastation*, and *Leander*; the French ironclads *Admiral Duperré*, *Dévastation*, *Rédoubtable*, and *Tempête*; the Russian circular ironclad *Novgorod*; the Dutch ironclad monitors *Haai* and *Matador*; and several Dutch unarmoured cruisers and gunboats. The most striking of these models are the French exhibits. The *Admiral Duperré*—model nearly 6 feet long, the vessel being 320 feet long. Her chief artillery features are the great height above water of her heavy guns, viz., 27½ feet; the fact that they fire *en barbette*, being fixed on turntables; and, lastly, her broadside armament of 5½ inch guns. This vessel has a great power of all-round fire with her four heavy 46-ton guns, which are placed two in barbette towers projecting over the ship's side on each bow, and two in towers over the keel, one in the middle of the quarter-deck, and one abaft the mizen mast. She has fourteen broadside 5½ in. guns. As to armour, she is only armoured vertically along her water-line and on her barbette towers, the thickness on the belt being 21·6 in., and on the towers 12 in. She has a horizontal armoured deck flush with the upper edges of the belt and hurricane decks, protecting the barbette guns from the fire of machine guns in tops. As to form, she has the two marked peculiarities of French armour-clad sea-going ships, namely, an enormous knife-like ram and the narrowed upper deck, due to the tumbling home of the sides. She is in the full sense a broadside ship, and fully masted. The *Redoubtable* has in a less degree the characteristic features of great command, narrowed upper deck, and knife-like ram. She is very flat bottomed, and has three keels. She is a central battery ship, armoured with 9½ in. plates on her central battery, and her water-line 14 in. plates, and having a horizontal armoured deck—2½ in. She has four powerful guns—12½ in.—in her central battery, three—10½ in.—in turntables on barbette towers on the upper deck, two light guns on her poop firing ahead, and six—5½ in.—broadside guns on the upper deck. The tumble home of her sides causes her citadel to project, and enables her heavy guns to have a great sweep of fire, shooting nearly fore and aft if necessary. This is again a fully masted broadside ship. The flaw in her is that she has a single screw, which puts her at a certain disadvantage in turning and ramming. The *Devastation*, this is another central battery and broadside ship. She has 15 in. of armour on her belts, and a horizontal armoured deck of 2½ in. The battery has 9½ in. She carries four heavy 13⅜ in. guns—query, 46 tons—in her central battery, two heavy guns—10½ in.—on her upper deck, and six medium guns—5½ in.—of which two are on the poop and four on the broadsides. The chief features in this ship appear to be the great power of her six heavy guns and the special power of depression, coupled with the high command of her two 10½ in. guns, which are considerably exposed, but receive some protection from a steel shield which moves on the traversing platform, beautifully shown on the model. There are also the usual features in this class of French ships of the tumbling home of the sides and projection of the citadel, with consequent wide sweep of guns, knife-like ram, &c. This vessel is, in our opinion, greatly in advance of the *Redoubtable*, which she resembles in many respects. She has twin screws. The *Tempête*, this is a first-class coast defender. She is protected with 11¾ in. of vertical armour, and 2 in. of deck armour, all beautifully shown in the model. She has one turret, with two 10½ in. guns. The peculiar form of turret adopted in the French navy with central conning tower is well seen in this model.


PRIESTMAN'S DREDGER AND EXCAVATOR. (*For description see page* 79.)

Messrs. Samuda exhibit the *Almirante Brown*, built by them for the Argentine Republic, launched October 6th, 1880. She has a belt of 9 in. of compound armour, with 'thwartship bulkheads, &c. She has a central citadel with a polygonal battery protected by from 8 in. to 6 in. of armour, and she has 1½ in. of horizontal armour. Her armament consists first of six 8 in. new type Armstrong breech-loading guns of 11½ tons each, mounted in the central battery, whose angles enable them to have a great power of all-round fire. She has also an armament of six lighter guns on her top deck.

There were various models of ancient craft, but they are chiefly interesting from an historical point of view. A beautiful model of the Viking's ship of 1000 years ago, from Norway, is, of course, of the greatest antiquarian interest. There are also models of the Royal Sovereign, which was built for Charles I. by Mr. Peter Pett; Nelson's flagship, the *Victory*, launched in 1765; the sailing three-decker, *Queen*, laid down in 1833 from the designs of Sir W. Symonds; the screw three-decker, *Howe*, laid down in 1856; the *Erebus*, built in 1856, the first iron-cased ship constructed for the British Navy; and a Dutch three-masted sailing ship built in 1779. There is also a very curious model of a fifty-nine gun frigate, built of ivory and fully-rigged, exhibited by Mr. Octavian Blewitt, which was made by the French prisoners confined in Milbay Prison, Plymouth, about the year 1810, and a full-rigged model of a two-decker found in a garret at St. Malo, then the property of an old sailor, which is supposed to have been made by one of the English prisoners during the war 1793-1815.

The awards of medals in the various sections have been made, and are evidently the result of careful and impartial consideration on the part of the judges. They are as follows:

To Messrs. Yarrow & Co. for torpedo boats adapted for a speed of 25 miles per hour, a gold medal; and to the same firm for their light draught stern-wheel river steamer, a gold medal. To Messrs. McMillan for model of sailing ship not exceeding 2,000 tons register, gold medal; and for a mail steamer for the American trade, honourable mention. To Mr. Shepherd for model of s.s. *Austral*, a gold medal. To Messrs. J. Thompson & Co. for model of s.s. *Aberdeen*, a gold medal. To Earle's Shipbuilding and Engineering Company (Limited), for steamer for the American trade, a gold medal; and for steam trawlers and carriers, a bronze medal and £10 10s. given by the Fishmongers' Company. For steamers for Channel service, Messrs. Stavanger, Stoberi, and Dok take the gold medal; M. Kundsen, silver medal, and M. G. Swensen, the bronze medal. Mr. Dahl has the silver medal for a model of side-wheel light draught river steamers.

In the class of sailing ships the gold medal has been awarded to Messrs. McMillan; silver medals to Messrs. Barclay, Curle & Co., and Mr. Archer, of Norway; bronze medals to Messrs. J. Duncan & Co., and M. T. Boe, of Norway; and honourable mention to M. Kundsen, and M. Ole J. Herlofson, both of Norway.

The gold medals for yachts are both awarded to Mr. G. L. Watson, of Glasgow. One is for a schooner yacht, and the other for a screw steam yacht. Mr. N. Paton takes the silver medal for schooner yachts; the Marquis of Ailsa for cutter yachts and yawls, and Messrs. White & Son, for screw steam yachts. Mr. H. Ratsey takes the bronze medal for schooner yachts; Mr. A. Payne, of Southampton, for cutter yachts; Mr. W. Watkins, of Blackwall, for screw steam yachts. Mr. E. Wilkins, of Nivenhoe, is highly commended for his model of cutter yacht.

The silver medal and £15 15s. added by the Fishmongers' Company for fishing smacks of from 50 to 60 tons is awarded to Messrs. Sims & Tooges, of Hull; and the bronze medal, with £10 10s. added by the Fishmongers' Company to Sir H. Peek, Bart, M.P. In the class of steam trawlers and carriers the silver medal and £15 15s. added by the Fishmongers' Company, and the bronze medal and £10 10s. also added by the Fishmongers' Company, are both awarded to vessels by Earle's Shipbuilding and Engineering Company, of Hull.

The gold medal for sailing barges of 100 tons and upwards is awarded to Messrs. Gill & Sons; the silver medal to Mr. Curel, and the bronze medal to Messrs. Surridge & Sons.

Messrs. Forrestt & Sons, of Limehouse, take the silver medal for lifeboats, and the bronze medal for ships' ordinary boats. Messrs. King & Co. are awarded the silver medal for ships' ordinary boats; Messrs. Bruyne & Zoon, of Holland, the bronze medal for lifeboats; Messrs. Messom & Son the silver medal, and Mr. J. Toyner the bronze medal for pleasure boats. The silver medal for steam launches has been awarded to the Koninklyke Company, of Holland, and the bronze medal to Messrs. W. White & Son, of the Isle of Wight. (*To be continued.*)

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Nutford.—On April 22nd, Messrs. J. L. Thompson & Son launched at Sunderland the *Nutford* (s), built to the order of Messrs. Thompson & Wrightson, of Sunderland. The *Nutford* is 240 ft. long, by 35 ft. beam, and 15 ft. depth of hold. She has a short full poop, a house over engine-room, and a topgallant forecastle. She is to carry 1,600 tons on 14 ft. The vessel will be fitted with compound surface-condensing engines by Mr. John Dickinson, of Palmer's Hill Engine Works; diameter of the cylinders, 28 and 54 with a 36-inch stroke. She will also be fitted with four powerful horizontal steam winches. This boat, which is the third built by the same firm for Messrs. Thompson & Wrightson, is intended more especially for the light draught of water ports, such a Bilbao, for which she commences her charter as soon as she is ready. As the vessel left the ways she was christened the *Nutford* by Miss Florence Thompson, daughter of one of the managing owners.

Duke of Westminster.—On April 27th there was launched from the premises of the Barrow Shipbuilding Company, at Barrow, a screw steamer of 3,600 tons, built of steel, and to the highest class at Liverpool, and named the *Duke of Westminster* by Mrs. John Fell, of Dane Ghyll. The principal dimensions of the *Duke of Westminster* are as follows:—Length, 400 ft.; breadth, 40 ft.; depth. 30 ft. The engines are of the ordinary compound direct-acting type, the cylinders being 43 and 86, and the stroke 54, and will indicate about 2,500-horse power. The vessel will have all the latest improvements in hull and engines, and will be fitted for about 40 first-class passengers.

Scaramanga.—On May 1st there was launched from the shipbuilding-yard of Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, an iron screw steamer of the following dimensions:—Length between perpendiculars, 256 ft.; breadth extreme, 35 ft.; depth of hold, 18 ft. She has long raised quarter-deck, bridge, and forecastle. Water ballast in after-hold and fore-hold. Gross register tonnage about 1,580 tons. She is built to the order of Messrs. Scaramanga & Co., of London, and is intended for the Mediterranean Trade. As she left the ways she was named the *Scaramanga* by Miss Brown, and at once proceeded to the Wallsend Slipway and Engineering Company's Works, where the vessel will receive her engine of 160 nominal horse-power.

Beny.—On May 2nd, a steamer, built at a Whitehaven shipyard for Mr. J. Hoult, Liverpool, was launched. She was christened the *Beny* by Mrs. Chalmers, of Liverpool. The steamer is 220 ft. long, 33 ft. breadth, 16 in depth, and 1,200 tons register. She is intended for the Demerara trade. She will leave in a few days for Liverpool, where her machinery will be fixed.

Welbury.—On May 3rd, Messrs. William Gray & Co., launched from their yard, at West Hartlepool, an iron screw steamer of the following dimensions:—Length, 270 ft. by 35 ft. 6 in. by 20 ft., class 100 A Lloyd's; built to the order of Messrs. Joseph Merryweather & Co., of West Hartlepool. She is intended for the Indian and general trades, and to carry 2,600 tons. She is fitted with double bottom in both holds for water ballast, and full poop, topgallant forecastle for crew, four steam winches, patent windlass by Messrs. Emerson, Walker & Co., London. The engines, which are 180-horse power, will be supplied by Messrs. T. Richardson & Son, of Hartlepool. On leaving the ways the christening ceremony was performed by Mrs. Merryweather, the vessel being named *Welbury.*

Roehampton.—On May 3rd, Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Mr. George Steel, of West Hartlepool, for Messrs. Steel, Young & Co., of London. Her principal dimensions are:—Length b.p., 285 ft.; beam extreme, 36 ft.; depth moulded, 25 ft. 2 in.; having a deadweight carrying capacity of about 3,000 tons. She has topgallant forecastle, long bridge house, and full poop; has double bottom for water ballast under both holds; the bulwark rails and main deck are of iron, and the upper deck of wood. She will be fitted with four steam winches, donkey boiler, Napier's steam capstan windlass, and the rig will be that of a double topsail schooner with iron foremast. The vessel has been built under Lloyd's special survey for the 100 A 1 class to the three-decked rule, and under the superintendence and inspection of Captain R. Sanderson, one of the senior Captains of the firm, who will take command of her. Engines of 180 nominal horse power will be fitted by Messrs. T. Richardson & Sons, of Hartlepool. On leaving the ways the steamer was christened *Roehampton* by Mrs. Gailey.

Glendower.—On May 4th, Messrs. Palmer's Shipbuilding and Iron Company launched from their Howden yard an awning-decked steamer of the following dimensions:—Length extreme, 303 ft. beam, 37 ft.; depth of hold, 29 ft. 6 inches. She was built to the order of Messrs. Lindsay Gracie & Co., Newcastle-on-Tyne, and was named the *Glendower* by Mrs. Gracie, wife of one of the owners.

Morning Star.—On May 6th, Messrs. Irvine & Co., West Hartlepool, launched from their yard an iron screw steamer, built for Messrs. Johnson Bros. & Co., of West Hartlepool and Cardiff. The vessel has been built to the highest class at Lloyd's; is intended for general trades; will carry about 1,500 tons; fitted with every modern appliance both for the rapid discharge of cargoes and navigation. She will have steam steering gear amidship, and patent gear aft, patent windlass by Emerson & Walker, patent water ballast tanks fore and aft on the cellular principle; three steam winches by Irvine & Co. The engines of 100-horse power, have been made by Messrs. T. Richardson & Sons, Hartlepool. Captain Robert Verrill will superintend the fitting out, and command the vessel when ready. On leaving the ways the vessel was christened the *Morning Star* by Mrs. Edward S. Johnson, wife of one of the owners.

Woolston.—On May 6th, Messrs. Oswald Mordaunt & Co., launched from their shipbuilding and engineering works, Southampton, a screw steamer of 4,500 tons, named the *Woolston*, of the following dimension, viz.:—Length, ;385 ft.; breadth, 44 ft.; depth of hold, 32 ft. The ship is built with topgallant forecastle, long bridge, and cape aft. She is fitted with Emerson & Walker's patent direct-acting capstan windlass for lifting anchors, and all the latest improvements. The engines, which are made by the same firm, are on the compound principle, having cylinders 52 in. by 94 in., and a stroke of 60 in. She has four double-ended boiler, with a working pressure of 90 lbs., and a total heating surface of 12,500 ft. She is also fitted with an auxiliary boiler, which can be used for the main engines or steam winches as required. The ship and engines are intended to take highest class at Lloyd's. The ceremony of naming the vessel was performed by Mrs. T. A. Oswald.

Grecian Monarch.—On May 6th there was launched by Messrs. Earle's Shipbuilding and Engineering Company (Limited), the new iron screw steamer *Grecian Monarch*, barque-rigged, with four pole masts, and of about 4,400 tons gross. Her dimensions are as follows:—Length, 380 ft.; breadth, 43 ft.; depth, 36 ft. 9 in. She is built to the order of the Royal Exchange Shipping Company (Limited); managing owners Messrs. John Patton, jun., & Co., London. She has provision for 640 tons water ballast in double bottom, and accommodation for 40 first-class passengers and 1,000 emigrants, or 600 head of cattle, and has a most complete system of ventilation. Built to the highest Lloyd's and Liverpool class, has engines of 420 n.h.p.; has cylinders 43 in. and 86 in. diameter, by 60 in. stroke, and two double-ended boilers and two single-ended ones. Working pressure 80 lbs. The model of this vessel has taken the gold medal at the Shipwrights' International Exhibition, held in the Fishmongers' Hall.

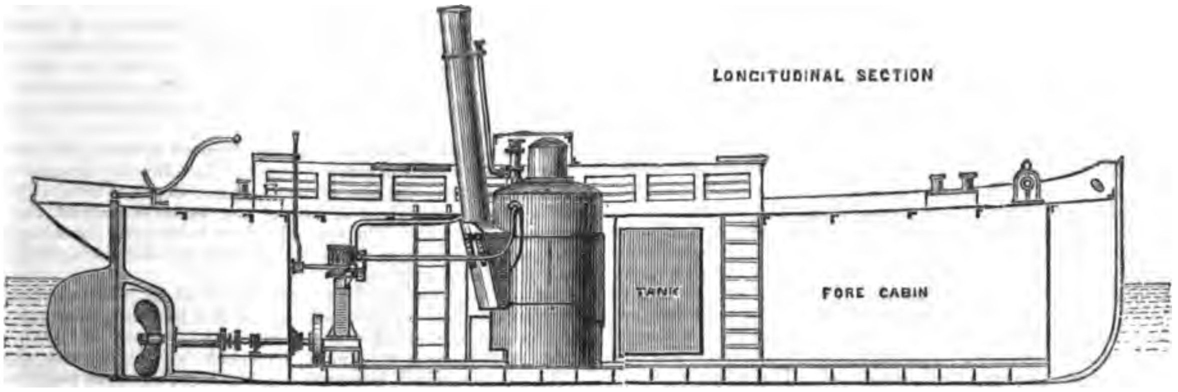
Etta.—On May 6th, William Gray & Co. launched from their yard at West Hartlepool, an iron screw steamer of the following dimensions:—Length, 245 ft.; breadth, 31 ft. 6 in.; depth, 15 ft.; built to the order of Messrs. Thomas Appleby & Co., of West Hartlepool, intended for general trade, to carry 1,450 tons. She is fitted with Emerson Walker & Co.'s Patent Windlass, and double bottom for water-ballast, and has a long raised quarter-deck, and topgallant forecastle for crew. The engines, which are being supplied by Messrs. Blair & Co. (Limited), are 110-horse power. On leaving the ways the christening ceremony was performed by Miss Appleby, the vessel being named *Etta.*

Venetian.—On May 6th there was launched from Messrs. Palmer & Co.'s iron shipbuilding-yard, Jarrow, the *Venetian* (s.), built to the order of Messrs. Frederick Leyland & Co., of Liverpool. The act of christening the vessel was performed by Mrs. J. H. Dale, of Westoe. The dimensions of the vessel are:—Length, 435 ft.; breadth, 41 ft.; depth, 29 ft. 6 in. She has three complete iron decks fore and aft, and she is built to take the higher class of the Liverpool Underwriters' Registry, and is considerably in excess of their requirements for that class of vessels. She possesses a double cylinder in fore and aft, with 9-inch air space. She has a turtle deck forecastle, with accommodation for crew and cattle men. On midships she has a deckhouse 150 ft. long, with accommodation not only for first and second-class passengers but the captain, officers, engineers, and firemen. She has a poop aft, with large store-rooms, and a wheelhouse with steam gear by Harrison's Steam Engine Company, Manchester, which is controlled directly from the wheel-house, the bridge, and aft. She is also fitted with Emerson & Walker's patent direct-acting steam windlass, and possesses a large crane on the forecastle deck for working anchors. She is fitted with four masts, and rigged with fore main masts with necessary booms, derricks, &c., also for the rapid discharge of cargo. She is specially fitted up for the cattle trade, and will carry about 700 head of cattle, along with 5,000 tons of cargo. She is also fitted with Brownlees' fresh water condenser, capable of condensing 8,000 gallons of water every 24 hours. She will be fitted with engines on the patent four-cylinder principle of G. Allibon, superintendent of the Company for which she is built. The two high pressure cylinders are each 29 inches in diameter; the two lower pressure cylinders 62 inches in diameter. The nominal horse power of the engines is 600. She has two cylindrical boilers, each 20 ft. long, by 16 ft. 6 in. diameter, built of Siemens-Martin's steel; the weight of each boiler being over 80 tons. The crank shaft is built on Turton's patent. The vessel is intended to run between Liverpool and Boston.

passengers. The holds will be kept free from vitiated air by Norton's patent ventilating apparatus. She has Davis's patent improved steam steering gear, the same machine that was shown at the late Engineering Exhibition in London. The *Warwick* has been built under the immediate direction of Capt. Harrison, the company's superintendent, and the machinery under that of Mr. Cross, the company's engineer. As soon as the vessel is ready she will proceed to Avonmouth Dock, Bristol, to load for New York.

Wild Rose.—On May 18th there was launched at the shipbuilding-yard of Messrs. Edward Finch & Co. (Limited), Chepstow, an iron screw tug steamer for Messrs. D. Guy & Son, of Cardiff, of the following dimensions:—Length, 85 ft.; breadth, 16 ft. 6 in.; depth, 10 ft. 6 in. Her engines will be 350 indicated horse power and 60-horse power nominal. She is to be fitted with all the essentials necessary for a screw tug. This is the third vessel Edward Finch & Co. have built for Messrs. D. Guy & Son. The vessel was christened the *Wild Rose* by Miss A. M. Guy, Mr. Guy's grand-daughter.

Scrivia.—On May 18th there was launched from the shipyard of Messrs. Raylton, Dixon & Co., Middlesbrough, an iron screw steamer, built for Messrs. Raggio & Co., of Genoa, and named the *Scrivia*, on leaving the ways, by Miss F. Dixon, daughter of the builder. This vessel is 310 feet long by 40 feet beam, and 25 ft. 3 in. depth of hold, and will have a deadweight capacity of over 3,600 tons, with 22 ft. 6 in. draught. She is built on the three-deck rule, with long bridge, poop and topgallant forecastle; has iron main deck and upper deck, laid with teak, and water ballast in fore and after holds and engine-room. She will be fitted with steam steering gear, Harfield's direct steam windlass, and all the latest improvements for vessels of this class. Her engines, of 220-horse power, are to be fitted by Messrs. T. Richardson & Sons, of Hartlepool. She is being built under the inspection of Signor Mattei, the eminent Italian Naval architect.



MESSRS. COCHRAN & CO.'S STEAM LAUNCH BOILER. (*For description see page* 80.)

Cambodia.—On May 16th Messrs. Robert Thompson & Sons, of Southwick, launched from their shipbuilding-yard an iron screw steamer, built to the order of Messrs. Crow, Bogart, & Rudolf, of Liverpool, under Lloyd's special survey, to class 100 A 1 for the spar-deck rule, and the personal superintendence of Captain Wildgoose. The dimensions are:—Length, 340 ft.; breadth, 40 ft.; depth, 29½ ft. The vessel has large deck-house aft, fitted up for passengers and captain, also hood for steering gear, long bridge amidships, with accommodation for officers and engineers, and for firemen and crew under monkey forecastle. She has flying bridge and wheel-house on top of bridge-house, five bulk-heads, water ballast in after and main holds, four steam winches and horizontal donkey boiler by Messrs. Welford & Wigham; Higginson & Co.'s patent steam quarter-master steering gear amidships, screw gear aft, Harfield's patent windlass, large fresh water tanks, condensed, and all the latest improvements. She will be fitted with engines of 1,800 i.h.p., with two large double-ended boilers by Mr. G. Clark, Southwick Engine Works. As the vessel left the ways she was christened the *Cambodia* by Miss Madge Briggs, of Sunderland.

Warwick.—On May 17th the steamer *Warwick*, built for the Great Western Steamship Company, of Bristol, was launched from the yard of Wigham Richardson & Co. The christening ceremony was performed by Miss Ada Whitwill, the daughter of the managing director; and immediately after the launch the steamer was towed to the 100-ton shears in the builders' yard, to take in her machinery, which is of 360 nominal horse power, manufactured by the same firm. The *Warwick* is a vessel of 2,600 tons builder's measure, is constructed of Siemen's steel, and is provided with every appliance for Atlantic service. She has three decks laid; the upper 'tween decks will be fitted up for a limited number of

Lucero.—On May 19th, Messrs. Osbourne, Graham, & Co. launched from their building yard at North Hylton a screw-steamer of about 2,000 tons deadweight, and of the following dimensions:—Length, 250 ft.; breadth, 35 ft.; depth, 17 ft. 6 in. She is classed 100 A 1 at Lloyd's, and has been built for Alderman Pecket and Councillor J. S. Thompson, and resold by them to F. de Carranza and partners, of Bilbao. Her engines, of 140-h.p., will be supplied by Messrs. J. W. & F. Wilson, of Sunderland. As the vessel left the ways she was named the *Lucero* by Miss Thompson, daughter of Councillor Thompson.

Gwenllian Thomas.—On May 20th there was launched from the Jarrow Yard of the Palmer's Shipbuilding Company, the iron screw steamer *Gwenllian Thomas*, built to the order of Mr. E. Thomas, of Porthcawl, Glamorgan. Her dimensions are 235 ft. by 31 ft. by 18 ft., and her deadweight carrying capacity 1,600 tons. The engines are Palmer's compound self-acting surface-condensing principle of 110-horse power nominal, the cylinders being 28 in. and 52 in. respectively, piston stroke 33 in. The steamer has long raised quarter-deck, long bridge over engine and boiler space, and topgallant forecastle, and is schooner-rigged.

Lilburn Tower.—On May 20th, a screw steamer of about 2,800 tons gross register, built for Messrs. Stumore, Weston, & Co., of London, was launched by Messrs. Doxford & Sons from the Pallion yard, Sunderland. Her dimensions are:—Length, 335 ft.; beam, 37 ft. 3 in.; depth, 28 ft. 9 in. She is built of the highest class at Lloyd's, and carries a Board of Trade passenger certificate. The engines, of 1,500 indicated horse power, are also by Messrs. Doxford & Sons. The ship has a cubic cargo capacity of 5,250 tons, and a deadweight capacity of about 4,000 tons. She is fitted with steam windlass and steering gear, steam starting gear to the engines, and all modern improvements. The vessel is expected to steam 11 knots. She was christened as she left the ways by Mrs. M'Nab, of Belfast.

Cephalonia.—The first steamer built by Messrs. Laird Brothers for the Cunard Steamship Company, and the largest merchant vessel ever constructed on the Mersey, was successfully floated on May 20th, the *Cephalonia* being christened by Mrs. William Laird, the Mayoress of Birkenhead, before a distinguished company. The contract for the *Cephalonia*, both for ship and machinery, was entrusted to Messrs. Laird Brothers, and she has been built, and engines and boilers put on board in one of their large building docks, under a permanent shed, and protected from the weather. Her dimensions are as follows:—Length extreme on upper deck, 440 ft.; ditto between perpendiculars, 430 ft.; beam, 46 ft.; depth in hold, 34 ft. 6 in.; tonnage, B.M., 4,530 tons; gross register, about 5,500 tons. The *Cephalonia* is constructed of iron, and is fitted to carry 100 first-class passengers and 1,500 steerage, besides her crew; she has four decks, a long bridge deck forming a promenade for passengers, a turtle-back deck aft covering in steering house, officers' room, &c., and a commodious forecastle forward, which contains petty officers' quarters and rooms for firemen and crew, ice-houses, &c. Three of her decks are of iron covered with good planking, which gives immense strength and rigidity to the ship. The first-class cabins occupy the midship portion of the vessel; the main saloon is forward of engine and boiler room, and extends the full width of the ship, and is luxuriously fitted up for passengers; it is lighted by large side lights in the sides of the vessel, and by an aperture in the centre of the roof. On the upper deck a large house extends the whole length of the bridge deck; the fore end of this contains the music room and entrances to saloon and cabins, abaft this officers' cabins, galleys, and other offices. The steerage accommodation will be fitted on the main deck aft, and on the 'tween decks for the whole length of the ship. Special care has been taken in the ventilating and warming arrangements, which are of the most approved style, both in first class and steerage spaces. The ship will be lighted by Swan's electric light, both in engine-room and in cabins, and pneumatic bells fitted to each room. The rig is that of a barque, with good spread of canvas. The masts are of steel, the fore and main being in one piece up to topmasthead. The mizenmast is in one piece for the whole length; the lower yards are also of steel. In addition to the accommodation for the large number of passengers, the dead weight and cargo capacity, from 4,500 to 5,000 tons, will probably be as great as any vessel afloat. The appliances for loading and discharging cargo are of the most approved kind, five very powerful steam winches, made by Messrs. J. Taylor & Co., of Birkenhead, being fitted at the hatchways. The windlass is worked by steam, and is connected to a powerful warping capstan on the forecastle deck, and there is also a steam capstan aft. The vessel will be steered by steam steering gear, worked from the chart house on the bridge as well as aft. Telegraphs are fitted on both upper and lower bridges, by which the officer in command can communicate with steersman and engine room. The machinery is on the compound system. The engines have two cylinders, the high-pressure one being 52 in. diameter, and the low-pressure one being 93 in. diameter, with a stroke of piston of 5 ft 6 in. The crank shaft is one of Vickers' built up steel shafts. The propeller is four-bladed, the boss as well as the blades being of Vickers' cast steel, and the blades are secured to the boss by steel bolts and nuts. The boilers are six in number, arranged in two sets of three each and having one funnel. They are cylindrical, 15 ft. 10½ in. diameter and 10 ft. long, and each boiler has three furnaces, which are fixed athwartships, the stokehole being in the middle of the ship, and having three boilers on each side. They will be worked at a pressure of 90 lbs. per square in., having been proved to 180 lbs. by water pressure. The shells and combustion chambers have been made of steel, and the furnaces are corrugated. The engine castings have been made in Birkenhead by Messrs. G. Bayliff & Son, of the Wirral Foundry, and the stern frame and rudder by Messrs. Clay, Inman & Co., of the Birkenhead Forge. It may be of interest to state that the first plate for the keel of this large ship was placed on the blocks on the 21st of May, 1881, and that she is now so far complete that steam was up and the engines moved round on Thursday, the 18th May. It is estimated that the weight of the ship when floated will not fall far short of 5,000 tons; so that this great weight of material has been put together in about 300 working days.

Guildford.—On March 21st there was launched by the Palmer's Shipbuilding and Iron Company the new iron steamer *Guildford*, of the approximate tonnage of 2,250 gross. Her dimensions are: Length, 298 ft.; breadth, 37 ft.; depth, 24 ft. 9 in. She was built to the order of Messrs. J. Temperley & Son, Newcastle. The diameter of her cylinders are 36 and 68, 45 stroke. Has engines of 210 nominal horse power.

Admiral Rooke.—On May 24th there was launched from the shipyard of Messrs. Raylton, Dixon, & Co., an iron screw steamer, which was named the *Admiral Rooke*, built for Gibraltar owners, and of the following dimensions:—Length over all, 250 ft.; breadth, 34 ft.; depth of hold, 17 ft. She will carry about 1,750 tons, and is built on the raised quarter-deck rule, having iron main and quarter deck, water ballast, steam winches and steering gear and all the latest improvements. She will be fitted with engine[illegible] of 130-horse power by Messrs. Blair & Co., Limited, of Stockton and is the first of two sister vessels Messrs. Dixon are building fo[illegible] the same owners.

LAUNCHES.—SCOTCH.

Bonnie Princess.—On April 22nd a saloon paddle steamer w[illegible] launched from the yard of Messrs: T. B. Seath & Co., Ruthergle[illegible] The vessel, which has been built to the order of the Liverpo[illegible] Llandudno, and Welsh Coast Steamboat Company (Limite[illegible] Liverpool, and which is intended to ply daily between Liverp[illegible] and Llandudno, Bangor, and the Menai Straits, is the largest t[illegible] has yet been built at the Rutherglen Shipbuilding yard, her dim[illegible]sions being 250 ft. long, 26 ft. broad, inside of paddle-boxes 20 [illegible] broad, 50 ft. broad over sponsons, 9 ft. 6 in. deep to main d[illegible] and 17 ft. to saloon or promenade deck. The ceremony of nam[illegible] the vessel *Bonnie Princess* was performed by Miss Ritsie Lath[illegible] Birkenhead.

Patria.—On April 22nd, Messrs Murdoch & Murray launche[illegible] at Port Glasgow an iron screw steamer of the following dimensions[illegible] Length, 205 ft.; breadth of beam, 29 ft.; depth of hold, 15 ft. [illegible] in. Miss Murray, daughter of one of the builders, named the [illegible] steamer the *Patria*. The *Patria* has been built under the superin[illegible]dence of Captain A. G. Ahlstrom. Messrs. Kincaid & Co., Green[illegible], will supply the engines.

Wardleys.—On April 27th, Messrs. Murdoch & Murray laun[illegible]ed at Port Glasgow a twin-screw tug of the following dimensions [illegible] Length, 90 ft.; breadth of beam, 19 ft.; depth of hold, 9 ft. Messrs. Rankin & Blackmore, Greenock, will supply the engin[illegible]. The steamer, which is named the *Wardleys*, has been built to [illegible] order of Messrs. Hebron & Ramsden, Liverpool.

Henry James.—On May 1st, Messrs. Dobie & Co. launche[illegible]d, from the Govan Shipbuilding-yard, an iron sailing barque, built to the order of the North British Shipping Company, of Glasgo[illegible]. She is fitted with patent capstan windlass by Messrs. Emerso[illegible] Walker & Co., London. The vessel measures about 1,000 to[illegible] gross, and is classed 100 A 1 at Lloyd's. As the vessel left th[illegible] ways she was named *Henry James* by Miss Whyte, of Pinelea[illegible] Helensburgh. Messrs. James Dunn & Sons are to load the *Hen*[illegible] *James* for Buenos Ayres.

Napthlion.—On May 1st, Messrs. H. M'Intyre & Co. launched from their shipbuilding-yard at Merksworth, Paisley, the *Napthlion*, an iron screw steamer of about 300 tons nett register, built to the order of D. P. Gudi, Esq., of Piræus, Greece, for passenger and goods traffic in the Greek Archipelago. Her dimensions are 180 by 26 by 14, with compound surface-condensing engines of 95-horse power, and 33 in. stroke. She has two cabins aft, fitted up for 50 first-class passengers, and has accommodation forward for a large number of second and third-class passengers. The engines will be supplied by Messrs. Hutson & Corbett, Glasgow. This vessel is the third built by Messrs. M'Intyre & Co. for the same owner, and, like the others, has been superintended by Captain N. P. Gudi, the Commodore of the fleet. The ceremony of naming was performed by Miss Stewart, Glasgow.

Insulinde.—On May 1st, Messrs. John Elder & Co. launched from their Fairfield Works the *Insulinde*, an iron screw steamer, built to the order of the Stoomvaart Maatschappy Nederland o[illegible] Amsterdam, and which will form an addition to their fleet of mai[illegible] steamers trading between Holland and Java by the Suez Canal Her principal dimensions are as follow:—Length between pe[illegible]pendiculars, 350 ft.; breadth, 39 ft.; depth moulded, 30 ft. 9 in. gross tonnage, 3.100 tons. The engines, which are being suppli[illegible] by the builders, are of the compound inverted cylinder type, wi[illegible] high-pressure cylinder, 42 in. in diameter, and low-pressure cylin[illegible] 88 in. in diameter by 48 in. stroke. Steam is supplied by t[illegible] double-ended cylindrical boilers at a pressure of 80 lbs., the i[illegible] dated horse-power being 2,500. The vessel has been built to the highest class at Lloyd's, and Bureau Veritas. She is fitted with steam windlass, Downton pumps, distilling apparatus, steam steering gear, steam winches, in short with all the modern improvements for safe navigation and for ensuring the comfort and safety of passengers. Accommodation has been provided for 60 first-class and 40 second-class passengers, besides large 'tween deck accommodation for troops. As the vessel left the ways she was named the *Insulinde* by Miss Brewer, of Brighton.

Dabulamanzi.—On May 2nd there was launched from the building-yard of Messrs. Hall, Russell, & Co., Aberdeen, an iron screw steamer of the following dimensions:—Length, 270 ft.; breath, 35 ft. 6 in.; depth, 26 ft.; and 1,640 tons gross. This vessel, which has been built under special survey to class 100 A at Lloyd's, will be fitted with compound surface-condensing engines, 200-horse power nominal, steam steering gear, Harfield's steam windlass, steam winches, iron pole masts, crane for working anchors, and all the latest appliances for facilitating the loading and discharging of cargoes, and also for navigating the ship. This vessel is built on the cellular double bottom principle, and is fitted with water ballast tanks throughout the whole length of the ship. This vessel has been built to the order of Messrs. J. T. Rennie & Sons, and is intented for the London and Natal trade. As the vessel left the ways she was named *Dabulamanzi* by Miss Garden, and was afterwards taken to the sheer poles for the purpose of receiving masts and machinery.

Marsala.—On May 3rd, Messrs. Alexander Stephen & Sons launched at Linthouse, Govan, an iron screw steamer, of about 2,400 tons, of the highest class in Lloyd's, built to the order of Messrs. Robert M. Sloman & Co., of Hamburg, and intended for the Sloman Australian Line. She is provided with a neat chamber and refrigerating machinery for conveying dead meat from the Colonies, and has all the best modern appliances for working ship and cargo, including Emerson Walker's patent windlass. Her engines, also of Messrs. Stephen's construction, have cylinders 38 in. and 68 in. diameter by 42 in. stroke, with ample boilers adapted for 80 lbs. pressure; and the vessel, which is a sister ship to the *Sorrento* recently launched at Linthouse, was named the *Marsala* by Miss Maud Stephen, of Glasgow.

Kenmore.—On May 3rd, Messrs. John Reid & Co. launched at Port Glasgow an iron barque of 1,030 tons builders' measurement, to the order of Mr. R. B. Finlay (of Messrs. Campbell, Finlay, & Co., Greenock). As she left the ways Miss Finlay named the vessel the *Kenmore*. After fitting out, the *Kenmore* will proceed to Glasgow to load for Sydney, as one of Messrs. Aitken, Lilburn, & Co.'s line of packets. The new vessel has been built under the superintendence of Mr. James M'Ewan, Greenock. She is to be commanded by Captain Milne.

Mallard.—On May 4th there was launched from the shipbuilding yard of Messrs. Gourlay Brothers & Co., Dundee, a fine new steamer, which has been built to the order of the General Steam Navigation Company, London, and which is to be employed in the Continental trade. Her dimensions are—Length, 225 ft.; breadth, 33 ft.; and depth of hold, 17½ ft. Her gross tonnage is 1,300, and she is classed 100 A at Lloyd's. The vessel, which was named the *Mallard*, has been constructed on the double bottom system, is to be schooner-rigged, and will be fitted with compound surface condensing engines of 140 horse-power. All the latest improvements and appliances have been introduced for loading and discharging cargo, and the steamer will be fitted out with all despatch.

Snack.—On May 4th, Messrs. William Denny Brothers launched from Leven Shipyard, Dumbarton, a small steel screw steamer intended for service in connection with their yard. Her dimensions are:—Length between perpendiculars 81 ft.; breadth (moulded), 16 ft.; depth (moulded) 7 ft. 9 in.; and tonnage (gross measurement) about 60. On leaving the ways the vessel was named the *Snack* by Miss Brock, daughter of Mr. Walter Brock, of Levenford, partner in the firm of Messrs. Denny, Bros. The *Snack* will be fitted by Messrs. Denny & Co. with a pair of compound surface condensing engines, having cylinders 12½ in. and 22 in. diameter, and stroke of piston of 15 in. Steam of 90 lbs. pressure will be supplied by one circular steel boiler, having large corrugated steel flue. An interesting feature in connection with this vessel is that she has been fitted for experimental purposes with zinc sheathing, soldered to the bare plates, by Mr. Joseph Atkinson's process.

Gaviota.—On May 5th Messrs. John Fullerton & Sons, shipbuilders, Merksworth, Paisley, launched a steam yacht named *Gaviota*, built to the order of Don Tomas Heridia, of Malaga, Spain, through their agents in London, Messrs. Bell & Higgins. The yacht has been designed by St. Clare Byrne, Esq., of Liverpool. The engine and boiler were put on board while on the stocks by Messrs. Thomas Reid & Sons, St. Mirren Engine Works, Paisley, who also supplied the steam windlass. On leaving the ways the yacht was named by Miss Ferguson, Merksworth House, Paisley.

On May 5th, there was launched from Kelvindock Boatbuilding Yard (Messrs. Wm. Swan & Co.), a little iron screw-steamer of about 110 tons, built to the order of Morris, Munro & Co., for their coasting trade. The steamer was built on the side of the dry dock, and had therefore to be launched broadside into the water. The engines, &c., are to be put in by Messrs. Clarkson & Beckett, Maryhill.

Cuxhaven.—On May 5th there was launched from the Caledon Shipbuilding Yard (Mr. W. B. Thompson's), a fine steamer which has been built to the order of the Yorkshire Coal and Steamship Company, Limited, Goole. Her dimensions are—length, 220 ft.; breadth, 32 ft.; depth of hold 13½ ft. Her gross tonnage is 950, and she is classed 100 A1 in Lloyd's. The vessel, which was launched by Alexander Meek, Esq., of Glen Ville, Brough, East Yorkshire, the company's manager, and named the *Cuxhaven* by his daughter, Miss Annie Meek, has been constructed with water ballast in double bottom, is to be schooner rigged, and will be fitted with compound surface condensing engines of 150 h.p., built at Mr. Thompson's Tay Foundry. She is to be fitted with steam steering gear, Messrs. Emerson Walker's patent windlass, and all the latest improvements have been introduced for loading and discharging cargo. The fitting out of the vessel has been superintended by Captain Ayre, who also superintended the two former vessels built for the same company by Mr. Thompson. She will be considerably the largest and most powerful vessel presently trading from the port of Goole. After the launch the company was entertained to cake and wine. The usual toasts were given and responded to.

Stratheden.—On May 6th Messrs. Henry Murray & Co. launched from the Sandpoint Shipbuilding-yard at Dumbarton, a screw steamer of the following builders' dimensions:—360 ft. by 38 ft. by 16 ft. The vessel, which will be fitted up with engines by Messrs. Ferguson & Fleming, engineers, of 100-horse power nominal, is 1,900 tons gross, and has been built to the order of Messrs. James Hay & Sons, Glasgow, and will be employed in the foreign coal, ore, and grain trade. As the vessel left the ways she was named the *Stratheden* by Miss Bulloch, Glasgow. The *Stratheden* has been fitted with Kunstädter's patent screw steering apparatus. This being the first vessel built in Scotland fitted up with this apparatus, a large number of shipowners and others were present at the launch. The apparatus consists of a screw, which the inventor calls the rudder screw, mounted on the hinder part of the blade of the rudder. The shaft of the rudder screw is carried by the rudder, the motion given to the shaft and rudder screw from the main shaft, to which the shaft of the rudder screw is attached by a universal joint, which causes the rudder screw to revolve, and at the same time allows the rudder to be moved from side to side without hindrance. It is considered that the vessel so fitted more readily answers her helm, thus facilitating her movements and simplifying navigation in a narrow river.

Mona's Isle.—On May 16th the paddle steamer *Mona's Isle* was launched at Messrs. Caird & Co.'s shipbuilding yard at Greenock. She is built for the Isle of Man Steampacket Company, and is to be put into that company's passenger trade between Douglas (Isle of Man) and Liverpool. The dimensions of the steamer are these:—Length, 330 ft.; breadth, 38 ft.; depth (moulded), 15 ft. 6 in.; gross tonnage, about 1,650. The vessel has three decks, and her furnishings include promenade, saloon, and dining saloon. She will have accommodation for 1,400 to 2,000 passengers. Messrs. Caird & Co. are furnishing engines for the *Mona's Isle*. They are surface-condensing engines, oscillating type, and of 800-nominal horse power, to work up to 4,500-horse power. Steam will be generated in four double-ended boilers, constructed of steel. The working pressure of steam will be 90 lbs. to the square inch. The *Mona's Isle* is to be commanded by Captain M'Queen. She was towed after her launch to the Victoria Harbour to receive her engines.

Ischia.—On May 17th Messrs. David and William Henderson & Co. launched from their building-yard at Partick an iron screw steamer of the following dimensions:—Length, 340 ft.; breadth, 37½ ft.; depth, 29½ ft.; gross tonnage, 3,100 tons. As the vessel left the ways she was named the *Ischia* by Miss Norah Henderson. The *Ischia* will be supplied by her builders with engines of 480-horse power, and will be fitted with all the latest improvements. When completed she will be placed on the berth for Bombay, and form the latest addition to the Anchor Line fleet.

Inverarnan.—On May 17th Messrs. Barclay, Curle & Co. launched from their building-yard at Whiteinch an iron sailing ship, built to the order of Messrs. J. Macgregor & Son, Greenock, of the following dimensions:—Length, 250 ft.; breadth of beam, 38 ft.;

depth of hold, 23 ft.; 1,500 tons register. On leaving the ways the vessel was named *Inverarnan* by Miss Macgregor, of Helensburgh. The *Inverarnan* loads at Glasgow for Calcutta.

Wairarapa.—On May 17th, Messrs. Wm. Denny & Brothers launched from Leven Shipyard, Dumbarton, a steel screw steamer, of about 1,800 tons gross measurement, for the Union Steamship Company of New Zealand (Limited). On leaving the ways she was named the *Wairarapa* by Mrs. Ward, wife of Mr. John Ward, manager of the Leven Shipyard. The dimensions of the vessel are:—Length between perpendiculars, 285 ft.; breadth moulded, 36 ft.; depth moulded, 25 ft. She has been built of Siemens-Martin steel under special survey of Lloyd's, and classed in their register 100 A 1, three-decked, being constructed on the continuous cellular double-bottom principle, with solid floors, and adapted for water ballast. She will have accommodation for 136 first-class passengers and 117 second-class, while portable fittings for a large number of third-class passengers will be provided in 'tween decks. The vessel will be fitted by Messrs. Denny & Co. with compound surface-condensing engines of about 2,000-horse power indicated, the cylinders being 41 in. and 70 in. in diameter, and length of stroke 48 in. While under construction the vessel has been under the inspection of Mr. John Darling, superintendent engineer of the company.

Boadicea.—On May 17th a steam yacht was launched from the works of Messrs. John Elder & Co., on the Clyde, for the head of the firm, Mr. William Pearce (the Vice-Admiral of the Mudhook Yacht Club). As the vessel left the ways she was named the *Boadicea* by Mrs. Pearce. The new yacht is 180 ft. in length, 24 ft. 2 in. beam, and 13 ft. 11 in. deep (moulded), with a yacht measurement tonnage of 446. The new yacht, which is expected to be propelled at the rate of 15 knots per hour, is built of steel, and her engines are of the most recently improved type, having cylinders of 23 in. and 46 in. diameter by 2 ft. 6 in. stroke, to indicate 600 horse-power. The boiler is to carry 110 lbs. pressure, and is constructed with a shell of the best soft steel and corrugated furnaces. The propeller is of Manganese bronze. The *Boadicea* has a cutwater stem and elliptical stern, which gives her a light, graceful appearance on the water; is schooner-rigged, and provided with steam windlass and steam steering gear on the bridge amidships, besides hand steering gear aft.

Teviotdale—On May 18th there was launched from the shipbuilding-yard of Messrs. R. Steele & Co., Greenock, a steel screw steamer of the following dimensions:—Length, 225 ft.; breadth, 35 ft.; and depth, 22 ft. Her gross tonnage is about 1,500, and she will be fitted with engines of about 180-horse power nominal. She has been built for Messrs. R. Mackill & Co., Glasgow, and on leaving the ways was named the *Teviotdale* by Miss Reid, daughter of Mr. Reid, Springburn, Glasgow. After the launch, the steamer was towed to the East India Harbour, where her engines, which are supplied by the builders, will be put on board.

Arisaig.—On May 20th Messrs. Blackwood & Gordon launched at Greenock a steel screw steamer, named the *Arisaig*, of the following dimensions:—Length over all, 248 ft.; breadth of beam, 33 ft.; depth of hold, 16 ft.; of 1,300 tons; to class 100 A 1 at Lloyd's. The engines, supplied by the builders, will be of 120-horse power; cylinders, 28 in. and 54 in., with a stroke of 36 in.; boiler pressure, 80 lbs. The *Arisaig* has the patent steam steering geer of Messrs. Bow, Maclachlan & Co., Paisley. She is also fitted with cellular water ballast tanks for 350 tons. The owners are Messrs James Gardiner & Co., George's-place, Glasgow. The new steamer will engage in the Mediterranean trade.

LAUNCHES.—IRISH.

Lord Downshire.—On April 29th a steel sailing vessel was launched from the shipbuilding works of Messrs. Harland & Wolff, Belfast. The vessel, which is named the *Lord Downshire*, is 292 ft. long, with 41 ft. breadth of beam, 24 ft. depth of hold, and probable registered tonnage 2,300. The *Lord Downshire* is owned by Messrs. Thomas Dixon & Sons, Belfast, and is sister to the ships *Lord Dufferin* and *Lord Cairns;* the rigging will be that of a four-masted barque.

River Forth.—On May 5th a screw steamer was launched from the shipbuilding-yard of Messrs. Workman, Clark & Co., Spencer Dock, Belfast. The ceremony of christening was performed by Miss Kemp, and the name of the steamer is *River Forth.* James Little & Co. are the owners. The dimensions are:—Length, 230 ft.; breadth 30 ft.; depth of hold, 16 ft. 6 in.; and the gross tonnage is 1,250. The *River Forth* has been built under special survey. The engines, which will be placed amidships, are of 120-horse power, and the length of stroke is 3 ft. 6 in. They are compound, direct-acting, and surface condensing, and are made with the latest improvements, by Messrs. Muir & Houston, Glasgow. The steamer will be fitted up at Belfast.

Lenore.—On May 18th there was launched from the Belfast Shipyard (Messrs. Workman, Clark & Co., Limited) a schooner yacht for Mr. George Smith, of the firm of George Smith & Sons, Shipowners, Glasgow. She is of the following dimensions:—Length on load-line, 89 ft.; breadth extreme, 17 ft. 5 in.; tonnage, yacht measurement, 113 tons. The vessel is constructed entirely of steel, and is to class 100 A1 at Lloyd's. As she left the ways the ceremony of christening her the *Lenore* was performed by Mrs. Clark, wife of Mr. George S. Clark, managing director of the firm. The model of this yacht, when exhibited at the Shipwrights' Competitive Exhibition, London, was awarded the highest honours and gold medal of the society for beauty of design and excellence of workmanship. The vessel is now at the crane in the Prince's Dock, awaiting the stepping of her masts and completion of her racing outfit.

LAUNCH.—FRENCH.

Foudroyant.—On April 27th this new French ironclad was launched at Toulon. Her dimensions are 100 metres in length, 10 in depth, and 19 in width, while her total burden is nearly 10,000 tons. The engine, which is expected to propel her from 16 to 19 miles an hour, is of 1,500-horse power. There will be sixteen large guns of 25 to 34 centimetres in calibre on board, besides smaller ones. The construction of this large vessel is stated to have cost nearly 20,000,000 fr.

LAUNCHES.—SWEDISH.

Kong Ring.—On April 22nd this steamer was launched from the yard of the Kockums Engineering Works, at Malmö. She is a passenger steamer of about 900 tons, with engines of 650-horse power, and has been built to the order of the Söndenfjeldske-Norske Dampskibsselskab, of Christiania, to trade between Hamburg and that place.

Norrtelje.—On May 6th this steamer was launched from the yard of the Lindberg Works, Stockholm. Her dimensions are:—Length, 120 ft.; breadth, 23 ft.; she draws 7 ft. of water. Her engines will propel her at the rate of 13 knots an hour. She has been built to the order of the Roslagen Company, to trade between Norrtelje and Stockholm.

TRIAL TRIPS.

Aviemore.—On March 23rd this vessel, which was recently launched from Mr. W. B. Thomson's yard, left the jetty at Camperdown Dock, Dundee, for the purpose of having her engines tested. Mr. James Millar, the managing owner, several of the other owners and friends, also Mr. Thompson, were on board. The *Aviemore*, on her passage down the river, ran the measured mile at the rate of 11 knots per hour, which was considered very satisfactory. On reaching the Fairway Buoy, a course was shaped for St. Andrews, and after approaching the ancient city as closely as was consistent with safety, the vessel was headed in the direction of Fifeness. Shortly after the return passage had been commenced, the company adjourned to the 'tween decks, where a substantial luncheon was served. "Success to the *Aviemore*" was proposed and responded to with great heartiness, as were also several other toasts. In steaming up the river the vessel was steered towards Newport, and, after rounding the *Mars* training-ship, she was headed for the jetty, which was reached about five o'clock. During the cruise the engines worked very smoothly, and altogether the *Aviemore* well maintains the reputation of her builder. The weather during the day was all that could be desired, and every one on board thoroughly enjoyed the trip. After conveying a cargo of potatoes to London, the *Aviemore* proceeds to Burntisland. At the latter port she loads coals for the Baltic, whence she returns to Dundee with a cargo of flax. The convenience of having a low water jetty was strikingly manifested in connection with the *Aviemore's* trial trip, as, after lying alongside to embark her passengers, she was enabled to start at dead low water. Before the jetty was constructed it was necessary in such circumstances for the steamer to anchor in the roads, while the company were taken off to her in a tug.

Monkstown.—On April 25th the steamer *Monkstown*, built for the Cork, Blackrock, and Passage Railway Company, by Messrs. MacIlwaine & Lewis, of Belfast, left the Spencer Basin, and proceeded on a trip down the lough. Her dimensions are as follow:—Length, 138 ft.; breadth, 16 ft.; depth, 8 ft. 2 in.; register, 65 tons. She is licensed by the Board of Trade to carry 510 passengers, and is fitted up with a pair of oscillating jet condensing engines. The *Monkstown* has a 30-inch cylinder, with a 33-inch stroke, and the boiler pressure is 26 lbs. Two or three times the measured mile was run, the speed being 13 knots an hour.

Middlesbrough (*s*).—On May 1st the iron screw steamer *Middlesbrough*, built by Messrs. Raylton, Dixon, & Co., Cleveland Dockyard, Middlesbrough, for Messrs. Hogg & Henderson, of the same town, took her trial trip. Her dimensions are:—Length, 250 ft.; breadth, 34 ft. 8 in.; depth of hold, 15 ft. 6 in.; with a deadweight capacity of 1,630 tons. She has a long, raised quarter-deck, with bridge-deck over machinery, topgallant forecastle, iron decks, &c., and is fitted with Bow and M'Lachlan's steam steering gear, and all recent improvements. The engines are of 100-horse power nominal, by Messrs. Blair & Co., of Stockton.

Mamelena 3.—On May 3rd the new screw steam trawler *Mamelena* 3, built by Messrs. D. Allan and Co., Granton, for Messrs. Marcader and Sons, San Sebastian, went down the Firth of Forth on her trial trip. The steamer, which has a stout oak frame with pitch pine planking, is 92 ft. in length, 18 ft. 6 in. of beam, and 9 ft. 6 in. in depth. Her engines, made by Walker and Henderson, Glasgow, are surface-condensing, of 30-horse power, and she is of 80 tons register. The *Mamelena* 3 is designed by Mr. D. Allan, and is an exact counterpart of the model trawler which secured the gold medal at the recent International Fisheries Exhibition. She has two masts, with the usual sails, and is in every way a very handy boat. The day, unfortunately, was very wet, and in the early part of the afternoon rather boisterous. Going down the Firth, the steamer, having wind and tide against her, ran from the Bell Buoy at Inchkeith to the May Island in two hours and ten minutes, and coming back again she did a measured mile well within her guaranteed speed.

Moor.—On May 4th the Union Steamship Company's steamer *Moor*, just completed by Messrs. J. and G. Thomson, of Clydebank Foundry, Glasgow, for the Company's Cape Mail service, made her trial trip on the Clyde, attaining the mean speed of 15¼ knots per hour. The *Moor* will sail from London on the 17th inst., and Plymouth 19th, for the Cape of Good Hope.

Ingerid.—On May 7th the *Ingerid* (s), launched lately from the Port Glasgow yard of Messrs. Henry Murray and Co., went on her trial trip. In running the measured mile the steamer attained a speed of 11¼ knots an hour. She returned to Bowling in the evening. The *Ingerid* has been built to the order of Messrs. J. Rankin and Sons, Managers for Dutch owners, and is to trade between Amsterdan and Norway. The engines were supplied by Messrs. M. Paul and Co., Dumbarton.

Earl of Dumfries.—The trial trip of the above steamer, launched from the shipbuilding yard of Messrs. Elliot and Jeffery on March 29th, took place on May 10th. She left the Pier Head, Cardiff, at ten minutes to two, and ran across to Weston-super-mare, a distance of 12 miles, arriving there at twenty minutes to three. The engine worked admirably well. There were on board a party of influential gentlemen, and, on arriving at Weston, Mr. Elliot, senior partner of the firm, entertained them to tea at the York Hotel, returning home at Eight o'clock, after spending a very enjoyable afternoon.

El Almirante.—A new steam towing launch for coasting service was tried on the Mersey during the week ending May 13th, when her performances gave the utmost satisfaction to Messrs. Balfour Williamson & Co., of Liverpool, who have had her built by Messrs. Cochran & Co., of Birkenhead. The little vessel is named *El Almirante*, and is built of iron, and constructed in the strongest possible manner, so as to be adapted for rough usage; the length is 45 ft.; breadth, 10 ft.; depth, 6 ft.; and is fitted with a most substantial single cylinder high pressure engine, 9 in. diameter by 10¼ in. stroke, got up in the best possible manner, so as to run for years without repairs. The boiler, which gives an abundant supply of steam at a pressure of 100 lbs. per square inch, is of Cochran & Co.'s patent steam launch type, and every facility is given for cleaning and examination. The speed attained was considered to be very high when the dimensions of the vessel and power of machinery is considered, while her capacity for towing is certainly far above the average. The launch is intended for service in Valparaiso Bay, and will be shipped on the Pacific Steam Navigation Company's R. M. s.s. *Galicia*.

Nutford (s. s.).—The new screw steamer, *Nutford*, built by Messrs. J. & F. Thompson, for Messrs. Thompson & Wrightson's, "Fourth" Standard Steam Ship Company, left the North Dock at two o'clock on Wednesday afternoon, May 17th, for trial of machinery. She is 240 ft. long by 35 ft. beam, and 15 ft. depth of hold, being specially constructed so as to carry a cargo of 1,600 tons on a draught of only 14 ft. Her engines have been constructed by Mr. John Dickinson, at his newly erected riverside works, and were put on board by his 90-ton steam crane, which has lately attracted so much attention. The cylinders are 28 in. and 54 in. diameter, and the length of stroke 36 in., and throughout the trial they gave universal satisfaction. The ship was steered by Simey's Steam Steering Gear, which fully answered all expectations, it being quite noiseless and free from vibration. After steaming about for four hours, she sailed for Bilboa, where she will load iron ore for Rotterdam.

Clan Buchanan.—This screw steamer, the latest addition to the Clan Line, has lately arrived in the Mersey from Dumbarton, where she was built by Messrs. A. M'Millan & Son. The Clan Line, of which the managing owners are Messrs. Cayzer, Irvine & Co., of Liverpool and Glasgow, have now on the stocks no fewer than 13 other steamers of large dimensions, two of them being built at Leith, one at Dumbarton, four by Messrs. Napier, Shank & Bell, Glasgow, two by Mr. Scott, of Greenock, and four by Mr. Stevens; and when these are completed the firm will have in their possession a fleet of no fewer than 26 steamers, varying in tonnage from 2,080 to 4,200 tons. The *Clan Buchanan*, which is the first of six sister ships now being built—the names of the others being *Clan Drummond*, *Clan Graham*, *Clan Sinclair*, *Clan Mackenzie*, and *Clan M'Gregor*—is a steamer of 3,200 tons, with a deadweight capacity of 4,325 tons. She is specially built for trading between Glasgow and Liverpool and Colombo, Madras, and Calcutta, with which the Clan Line is opening up an export trade, with fortnightly steamers, which formerly went by way of London. The *Clan Buchanan* is 345 ft. long by 40 beam, and 30 ft. in depth. She is built of iron, in eight water-tight compartments, and is registered in the highest class at Lloyd's by special survey. She is double-bottomed, and carries water-ballast. Her engines were made by Mr. David Rowan, of Glasgow, and have two cylinders, 39 and 75 in. in diameter, with a four feet stroke. She has two double ended boilers, each 13 ft. in diameter by 16 ft. long, having eight of Fox's corrugated furnaces in all. The boilers have 105 ft. of grate surface, and 4,600 ft. of heating surface, and on the trial trip the engines showed an indicated horse-power of 2,200, with a speed of 13 knots, the guaranteed speed being 12 knots. She has saloon accommodation for 45 first-class passengers. She is supplied with combined steam and hand steering gear amidships and aft, and carries Sir Wm. Thompson's compasses, her winches having been supplied by Messrs. Paul & Co., of Dumbarton. On Saturday morning, in response to an invitation from the managing owners, about 250 ladies and gentlemen proceeded from Glasgow to Greenock by special train to join the *Clan Buchanan* for a day's cruise on the Firth of Clyde. The company embarked on board the *Clan Buchanan* about half-past 11 o'clock, when the steamer proceeded down the Firth at slow speed. The weather was very fine, and never was the beautiful scenery of the Clyde seen to better advantage. The Island of Bute was first skirted, after which the Island of Arran was approached, Holy Island was sailed round, and the Beautiful Bay of Rothesay was subsequently entered. Luncheon was served in the saloon, and the main deck, which under ordinary circumstances is devoted to the accommodation of cargo, was temporarily transformed into a dining-room, where in the course of the afternoon the whole of the guests sat down to a sumptuous banquet. The pleasant cruise was brought to a close about 8 o'clock, when, with the exception of a few gentlemen who were accompanying the steamer on to Liverpool, the party disembarked at Greenock, and returned by special train to Glasgow. During the whole of the passage to Liverpool, in charge of Capt. John Russell, her engines worked splendidly, and gave every satisfaction to those in charge of them.

TRIAL TRIP.—GERMAN.

Tritos.—On May 2nd the s.s. *Tritos*, built and engined by the Flensburg Shipbuilding Company to the order of the Flensburg Steam Navigation Company ran her trial trip in the Bay. She is a very handsome boat, built on the spar deck principle, and is of the following dimensions:—Length between perpendiculars, 258 ft.; extreme breadth, 34 ft.; 24 ft. 10 in. depth of hold to spar deck, with a nominal horse power of 160, and will carry about 2,200 tons deadweight. She is fitted with an iron house aft, which contains an elegant saloon, captain's state room, passengers' berths, &c. Also side houses amidships for officers and 2nd and 3rd engineers; chief engineer's berth, mess room, galley, and charthouse are fitted in the casing. She has a steam windlass, three steam winches, and all the newest improvements. Her deck has a very neat look, all skylights, companions, binnacles, rails, &c., being made of ' prime

East India teakwood." At the trial everything worked to the entire satisfaction of the owners, she obtaining a speed of 11 knots per hour.

TRIAL TRIP.—SWEDISH.

Excellensen Posse.—This steamer, which was launched from the yard of the Oskarshamn Engineering Works, Sweden, in February last, went on her trial trip on April 28th. She is a first-class passenger steamer of the following dimensions:—Length, 125 ft. between perpendiculars; beam, 21½ ft.; and draws 9 to 9½ ft. of water; she attained a speed of 10 knots. The vessel, which is built to the order of the Steam Navigation Company, Kontinenten in Ystad, will run between the latter place and Stettin.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

To the Editor of THE MARINE ENGINEER.

S.S. *Billow*, Suez.

SIR,—I see in last December part a communication advocating the use of indiarubber hose when bilge suction pipes become choked. This, no doubt, would act well as long as the fires were not extinguished, but when they are, what then? In most cargo ships permanent deck pumps are fitted with clumsy laborious gear, and when they are required soon become choked; I have experienced two cases—I will mention one. In the s.s. *A. of H.*, during a storm in the Atlantic, the bunker hatches were washed off; before they were made fast the fires were extinguished. All hands were ordered to the deck pumps, but they were all choked in twenty minutes or less with small coal. The order was then to *bale*, but the ship foundered, and we escaped "by the skin of our teeth." I would suggest portable hand deck pumps, with suction pipe in lengths—say five or six feet; these pipes would not take up much space, and could be lowered to any required depth. Had this appliance been on board the above ship, there was ample time to pump the water out and light the fires again.

Hoping you will pardon this intrusion on your valuable space,

I am, Sir, your obedient servant,

WILLIAM H. ACTON,
First Engineer.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 25th April to 22nd May.

1899 T. Lambert. Screw propellers.
1920 J. Keith. Boilers and heating apparatus.
1932 A. A. Young. Self levelling ships' berths.
1933 A. A. Young. Life preserving mattresses.
1944 J. A. Westerman (communicated to W. L. Wise). Raising, supporting, &c., ships.
1957 J. Ericsson (communicated to A. W. L. Reddie). Steering apparatus.
1958 G. W. Hawksley & M. Wild. Steam boilers.
1966 W. Begg. Prevention of smoke by furnaces.
1983 A. W. Cooper. Actuating gear for slide valve pumps.
1985 J. W. Kenyon. Low water alarm.
1994 W. Chadburn. Telegraphs for ships.
2000 Don Pástor Pérez de la Sala. Life saving appliances.
2011 D. Johnston. Corrosion of screw propeller blades.
2046 A. B. Brown. Windlasses.
2085 A. J. Davison. Screw propeller.
2102 J. I. Thornycroft. Steam generator
2111 A. F. Yarrow. Tubular boilers.
2118 F. Bosquet (communicated to A. J. Boult. Steam generators.
2180 G. C. Lilley. Ships' speed indicator.
2199 F. Maringer (communicated to G. W. Von Nawrocki. Steam ship screws.
2200 A. W. Tuer & J. Cleminson. Ships' position by signal lights.
2234 M. H. Holmes & J. R. Steiner (communicated to A. M. Clark). Life preserving bed.
2238 E. J. Mallett (communicated to J. H. Johnson). Boiler furnaces.
2241 S. Jones. Boilers.
2243 A. Kennedy. Capstans.
2245 J. R. Hodgson. Life buoys, boats etc.
2258 W. H. Weltern. Windlasses etc.
2285 J. W. Watts. Life mattresses.
2311 J. Anderson & W. C. Johnson. Submarine cable grapnels.
2322 G. Robson. Steam steering engines.
2324 A. W. Schultze. Steam boilers.
2341 W. E. Everitt. Metallic tube for boilers.
2356 J. Emery. Slide valves.
2366 S. Sheehan. For preventing explosions in boilers.
2379 H. C. Paterson. Consumng smoke.
2392 S. T. Adams & G. Adams. Screws for ship building.
2415 G. Bu nswangu. Low water alarm.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

Omitted in April 1st.		
Roskelly, W. T.	1 C	London.
April 29th, 1882.		
Armstrong, J....	1 C	London.
Black, David C.	2 C	Dundee.
Cumming, Alex.	2 C	Aberdn.
Donald, Robert	2 C	Glasgow.
Fearon, Wm. ...	2 C	Lvrpool.
Gardner, Robert	2 C	Glasgow.
Gibson, Wm. ...	2 C	N Shlds.
Haslam, James	2 C	Belfast.
Haswell, Wm....	1 C	Sndrlnd.
Hendry, Malcolm	2 C	Glasgow.
Johnson, Chas.	1 C	Sthmptn.
Maagensen, C. L.	2 C	N Shlds.
McDonald, Alex.	1 C	Glasgow.
M'Cudig, D. A.	1 C	Belfast.
Melville, James	1 C	Glasgow.
Meriton, T. W. B.	1 C	London.
Ogilvie, A. R....	2 C	Dundee.
Orr, James W...	1 C	Glasgow.
Palmer, John C.	2 C	Aberdn.
Preston, George	2 C	Glasgow.
Rendall, James	1 C	Aberdn.
Rooksby, J. M.	2 C	Lvrpool.
Sandberg, T. ...	1 C	Glasgow.
Sinclair, Finlay	1 C	do.
Smith, F. W. B.	1 C	London.
Smith, Walter...	2 C	N Shlds.
Taylor, George...	2 C	Sthmptn.
Thomson, A. D.	1 C	Glasgow.
Walker, Geo. ...	2 C	London.
Walker, James	2 C	Glasgow.
Williams, R. G.	1 C	N Shlds.
Wilkinson, F. ...	1 C	Lvrpool.
May 6th, 1882.		
Anstee, Geo. H.	2 C	Bristol.
Brodrick, W. H.	1 C	Hull.
Clee, Joseph ...	1 C	Bristol.
Currie, Matthew	2 C	Sndrlnd.
Den, Herder C.	2 C	N Shlds.
Finlay, Rbn. H.	2 C	London.
Hollingsworth, J. H..	2 C	Sndrlnd.
Jeffery, Emanuel	2 C	Bristol.
Kean, James ...	2 C	Lvrpool.
Knowles, Thos.	2 C	Bristol.
Marshall, J. T.	1 C	N Shlds.
Melville, T. B....	2 C	Lvrpool.
M'Lachlan, John	2 C	London.
Moss, Thomas...	1 C	do.
Ramsay, Walter	2 C	Hull.
Rendell, Wm....	1 C	London.
Robinson, J. R.	1 C	N Shlds.
Russell, J. W....	1 C	do.
Streader, W. Y.	2 C	Hull.
Taylor, W. A...,	2 C	Lvrpool.
Todd, Luke ...	1 C	N Shlds.
Watters, Thos.	2 C	Sndrlnd.
Wilson, W. W.	1 C	Greenock
May 13th, 1882.		
Adair, Robert...	1 C	Leith.
Brown, John ...	1 C	Lvrpool.
Buckham, Jos....	1 C	do.
Burges, William	2 C	Leith.
Christi, D. ...	1 C	Glasgow.
Crichton, John...	2 C	do.
Dawson, J. N....	2 C	London.
Dempster, Alex.	1 C	Glasgow.
Girdlestone, J.O.	2 C	Lvrpool.
Gray, Henry R.	2 C	N Shlds.
Harvey, R. A.	1 C	Plymth.
Hooper, Rbt. A.	2 C	N Shlds.
Houston, John...	2 C	do.
Lavis, James ...	2 C	Leith.
McArt, John R.	2 C	Lvrpool.
Mitchell, Wm....	1 C	Leith.
Russell, John ...	1 C	N Shlds.
Sayers, Robert	1 C	Glasgow.
Shield, Geo. ...	2 C	N Shlds.
Simpson, Geo....	1 C	Lvrpool.
Smith, J. T. ...	2 C	Glasgow.
Taylor, T. H. ...	1 C	London.
Thompson, W.	2 C	Leith.
Thurlow, F. ...	1 C	London.
Tomkins, G. W.	2 C	do.
White, R. ...	2 C	Glasgow.
Wilkie, R. ...	2 C	Leith.
May 20th, 1882.		
Allen, Arthur ...	2 C	N Shlds.
Birtley, John G.	1 C	N Shlds.
Calderwood, J...	2 C	London.
Cartwright, J. G.	1 C	Lvrpool.
Cockeram, W. H.	1 C	Hull.
Crichton, Alex...	2 C	do.
Davison, Wm....	2 C	N Shlds.
Fish, George ...	2 C	Hull.
Fraser, Hugh ...	2 C	N Shlds.
Goodall, Fred. G.	2 C	London.
MacKenzie, J.R.	2 C	Dundee.
McCauley, Saml.	2 C	Belfast.
Mooney, D.M.A.	2 C	London.
Moore, Alfd. W.	1 C	N Shlds.
Nettell, Wm. H.	1 C	Cardiff.
Plews, Wm. H.	2 C	do.
Price, John ...	2 C	do.
Sanderson, Rbt.	2 C	N Shlds.
Spiers, Harry J.	1 C	London.
Watson, David	2 C	N Shlds.
Williams, Wm...	2 C	Lvrpool.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

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The Subscription to " The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, JULY 1, 1882.

EDITORIAL NOTES.

THE condition of England's best defence—her Navy —is dear to the heart of every true Englishman. Little opportunity has any landsman to form any definite opinion as to strength and force of our present Navy compared with that we have gloried in and conquered with so often in days gone by. There is nothing more enervating to fresh endeavours than accomplished success. Are we resting blindly, and without proper grounds for assurance upon former successes, and falsely believing ourselves as invincible as heretofore? This is a serious question for the whole British nation, as more than ever does our existence as a nation depend upon our command of the seas. With our Navy destroyed and our ports blockaded we should shortly have a famine. Our Navy, like that of other countries, has undergone such a revolution that all our accumulated force of many years' supremacy have been wiped out, and are now as useless as if they had never existed. We have had once more to begin again on a par of equal footing with other nations, and build our Navy anew. Sir Thomas Symonds, a name well-known amongst us for gallant services and thorough knowledge of his service, has been at great trouble to place nakedly before us a statement, as to what we have done towards this re-building in the last few years, as compared with one of our neighbouring Powers with whom we have so often been in deadly rivalry. The comparison is startling, to say the least, and promises to become more so, year by year, if things go on as at present. Little the Austrians realized, till too late, the overwhelming change in Army warfare brought about by the introduction of the breech-loading needle gun. May we not some day as suddenly awaken to the fact that the supremacy of the seas has left us with the introduction of ironclads. That this will be our own pig-headed fault, should it occur, is obvious to any one. We have superior means and skill in such construction to any rival nation. Are we using our opportunities for precaution aright? We fear the " Peace at any price " policy may some day receive a rude shock from neglect of the surest means to prevent war—the adequate means of self-protection. So important is such a subject for the consideration that our thanks should be due to any one who endeavours to place simple facts forcibly before us. These statements from the pamphlet published, we intend to lay before our readers from time to time as our space will admit.

To turn to a lighter subject, we hear that a new weather compass has lately been invented by a Professor Klinkerfue, of Gottingen. The barometer, which alone is trusted to at present as a weather indicator, shows, as we all know, but the variation of the atmospheric pressure. Although this suffices generally to foretell the approach of a storm wave or heavy gale, there are many other features of the weather that a landsman, at any rate, is interested in. The probability of approaching heavy rain is a most important piece of information to most of us, and for this the barometer alone is comparatively useless, except when read in conjunction with the temperature and the amount of moisture in the atmosphere. Professor Klinkerfue has, therefore, very ingeniously combined with an aneroid barometer a hair hygrometer for indicating moisture and a thermometer for indicating temperature. He has so combined the action of these three instruments upon a single needle that they act differentially or accumulatively upon its motion. For instance, if a fall of atmospheric pressure, a reduction of temperature, and considerable moisture in the air occur simultaneously, they all have an accumulative action upon the movement of the needle to "rain." On the other hand, an absence of one or more of these concurrent symptoms produces a differential effect, reducing the action of the needle to any extreme indication.

THE new Italian Ironclad *Dandolo*, which has just been turned out of the Royal Naval Arsenal at Spezzia, is a sister ship to the *Duilio*, but exceeds her in speed. She is a very perfect vessel, and exceeds in power and general perfection of design anything as yet turned out by our dockyards. She carries two turrets, arranged diagonally, each mounting 100 ton Armstrong guns, and therefore capable of concentrating the power of all four guns, fore and aft. She has only one mast, which does not carry any sails fixed between her turrets and which therefore acts as a look out. The vessel is fitted with Forrester's steam steering gear as well as a very powerful hand steering gear, and has a beautiful self-acting arrangement, designed and fitted by the Italian constructors for checking and holding the tiller. In case the chains should break the tiller would lock itself amidships, and remain at rest till the new chain was reeved. The *Dandolo* is driven by two independant pairs of engines constructed by Messrs. Maudslay, Sons, & Field, and are the first compound engines which have been fitted to the Royal Italian Marine. The high pressure cylinders in each pair are 64 inches in diameter, and the low pressure cylinders 120 inches, both having 4 feet stroke. Steam is supplied at 65 lbs. pressure, and the engines have indicated an average of rather more than 8,000 horse power, giving a speed of 15½ knots. This is a splendid result for so heavy a vessel. A very perfect system of fan ventilation has been carried out, so that the whole of the cabins and even the engine room are kept perfectly sweet and fresh.

IT seems that carrier pigeons are to be enlisted in the service of the German Navy. They are chiefly to be employed as messengers between light-ships and the shore, not only to carry information of any distress on board the light-ship, but more frequently to convey information of vessels stranded or disabled. Timely information of their distress, may be thus brought to land, and help of some kind may be sent them. Experiments made during the last two or three years, have proved most successful from two light-ships, one 36 leagues distant, and the other nearer land. The birds have flown during heavy gales, 36 leagues in 30 minutes, an almost incredible speed. Such messengers would surely be invaluable to our light-ships off the Nore and the Goodwin Sands.

WE are sorry to see that the English Navy is by no means free from the petty peculation in stores that we are too apt to lay to the credit exclusively of foreigners, and particularly of Oriental races. We see that the Court-Martial, which has been engaged in investigating charges of alleged fraudulent dealing with ships' accounts, has convicted the steward, Oliver Jew, of her Majesty's ship, *Cambridge*. The whole system of receiving, checking, and serving out, seems to be shockingly badly managed, and the paymaster seems to have admitted that his duties are so multifarious as practically to prevent the possibility of his having time to audit or check the books. It is to be hoped that either those who have duties will consider them more than nominal, or that duties should be so distributed that there is ample time for their effective performance. The sentence upon the steward of eighteen months' imprisonment with hard labour and dismissal from her Majesty's service with disgrace, is sufficiently heavy to act as a severe warning to other subordinates not to presume upon an absence of efficient check to falsify accounts, or to lose the distinction between ***meum et tuum***.

THE Government seems at last waking up to the danger menacing our communications through the Suez Canal, should further complications arise in the settlement of Egypt. Two gun boats, the *Don* and *Dee* are being sent off in all haste to the Mediterranean by the *Hecla* torpedo ship, which has been ordered to join the squadron at Alexandria. Eighteen other gun-boats now on the ship at Haslar are also being overhauled ready for service in the Suez Canal, if required. Had these measures been taken earlier, the present crisis would probably never have reached so serious a stage.

AN exhibition, to be known as the North-East Coast Exhibition of Naval Architecture, Marine Engineering, Fishery, Life-saving, and Coast Lighting Appliances, is to be held at Newcastle-on-Tyne, and to be opened on the 6th September next. The Earl of Ravensworth, President of the Institution of Naval Architects, is president of the exhibition. Mr. G. Renwick is the honorary secretary, and Mr. Sidney Old is the acting secretary, and the offices are at 21, Collingwood-street, Newcastle-upon-Tyne. It is expected that the exhibition will be on a large scale, and will be well attended.

DIMENSIONS AND PERFORMANCE OF THE HULL AND MACHINERY OF THE UNITED STATES STEAMER "DISPATCH," WITH ANALYSES OF THE POWER DEVELOPED.*

By Chief Engineer Isherwood, U.S. Navy.

ACCURATE and complete data regarding vessels and their machinery, especially in the relation of the effect produced by the latter upon the former, are so valuable to the engineer, and so scarce, that the following facts in the case of the *Dispatch*, a merchant yacht-built and brig-rigged screw steamer, purchased for the United States Navy, will be of service in several respects.

They show the propelling efficiency of her screw, and the development of power with it possible under the conditions of the vessel, and of the space displacement of her pistons per stroke with the mean net pressure upon them; also, the steam-producing capacity of the boilers with common anthracite, and the cost of the power in fuel given by small simple engines using saturated steam above medium initial pressure and with more than the average measure of expansion.

The analyses of the power developed, rendered possible by the mean data from the very large number of indicator diagrams taken, show in what direction and to what extent it was expended, determine the resistance of the vessel at the experimental speeds, and ascertain its kind, and explain the cause of the inferior economic effect produced by the coal in proportion to power developed.

HULL.

The hull is of wood, coppered, and modelled for a yacht with much dead rise at the greatest transverse section. In addition to the proper central keel there is, on each side, a bilge keel, 50 feet long, the centre of which, transversely to the hull, is 9 feet 2 inches from the centre of the central keel. Each bilge keel is in cross section 25 inches wide on top, tapering to 9¼ inches wide on bottom, and 20 inches deep.

The following are the principal dimensions of the hull:

Length from forward edge of rabbet of stem to after side of body of sternpost	174 feet.
Extreme breadth	25·50 feet.
Depth at centre of length from top of deck plank to lower edge of rabbet of keel	15·33 feet.
Depth at centre of length from water line to lower edge of rabbet of keel	10·25 feet.
Depth of keel at centre of length below the lower edge of its rabbet	0·75 feet.
Breadth of keel	1·00 feet.
Draught of water forward	11·17 feet.
Draught of water aft	12·83 feet.
Mean draught of water	12.00 feet.
Area of the greatest immersed transverse section to 12 feet draught, exclusive of projected cross area of bilge keels	186·58 sq. ft.
Area of the water section at 12 feet draught ...	3163·34 sq. ft.
Displacement, exclusive of bilge keels, at 12 feet draught	19328·64 cu. ft.
Displacement, exclusive of bilge keels, at 12 feet draught	552·25 tons.
Centre of gravity of displacement abaft centre of length of water line	4·45 feet.
Centre of gravity of displacement below the water line	7·345 feet.
Displacement per inch of draught at 12 feet draught	7·5318 tons.
External immersed, or wetted, surface of the hull, exclusive of bilge keels, from bottom of central keel to 12 feet draught of water ...	5100·00 sq. ft.
Surface of the two bilge keels	416·00 sq. ft.
Total immersed, or wetted, surface	5516·00 sq. ft.
Ratio of length to breadth	6·8235
Ratio of greatest immersed transverse section to its circumscribing parallelogram	0·7138
Ratio of water section to its circumscribing parallelogram	0·7124
Ratio of displacement to its circumscribing parallelopipedon	0·4250
Ratio of displacement to a solid having for base the greatest immersed transverse section, and, for length, the length of the hull ...	0·5954

ENGINES.

There are two vertical, direct acting, simple engines, connected at right angles upon the same crank shaft. Each cylinder has, in addition to its main slide valve with a Stephenson link reversing gear, an independent adjustable slide cut-off valve. There is no exhaust lead, and the steam cushioning commences when the pistons are at 0·1667 of the end of their stroke. There is one tubular surface condenser, with the exhaust steam on the outside of the tubes, and the refrigerating water within them. The tubes are in two groups, one above the other, and the refrigerating water passes first through the tubes of the lower group, returning through those of the upper group. There are two vertical, single acting air pumps, and two single acting feed pumps. An air pump and a feed pump are worked from a lever which receives its motion from the crosshead of each engine. The refrigerating water is driven through the condenser by a centrifugal pump. The case of the pump is 46 inches in diameter over all, and 7 inches in width. The fans are 6 inches deep radially, set on arms 18 inches long from the axis to the centre of the fan. The pump is operated by one independent steam cylinder of 12 inches diameter and 10 inches stroke of piston. The condenser, the pump, and the independent cylinder are much too large in proportion to the weight of steam obtainable per hour from the boilers.

The cylinders and all the connecting steam pipes are well felted and lagged, but there are no steam jackets. The following are the principal dimensions of the engines:

Number of cylinders	2·
Diameter of one cylinder	33⅛ inches.
Diameter of the other cylinder	34¼ inches.
Diameter of the piston rods (one to each cylinder)	3⅝ inches.
Aggregate net area of the pistons (exclusive of rods)	1719·7804 sq. in.
Stroke of the pistons	2·75 feet.
Aggregate space displacement of the pistons per stroke	32·84303 cu. ft.
Aggregate space in the clearances and steam passages of both cylinders at one end	2·28917 cu. ft.
Per centum of the space displacement of the pistons per stroke, in the clearances and steam passages	6·97
Number of tubes (brass) in condenser	1294.
Outside diameter of condenser tubes	¾ inch.
Length of condenser tubes	55 inches.
Aggregate condensing surface, measured on outside of tubes	1164·5 sq. ft.
Number of air pumps (single acting)	2·
Diameter of air pumps	18 inches.
Stroke of air pump pistons	16 inches.
Aggregate space displacement of air pump pistons per stroke	4·7123 cu. ft.
Number of feed pumps (single acting)	2·
Diameter of feed pumps	3 5/16 inches.
Stroke of feed pump plungers	16 inches.
Aggregate space displacement of feed pump plungers per stroke	0·1596 cu. ft.

BOILERS.

There are two cylindrical steel boilers, placed opposite each other, with an athwartship fire room between them. The boilers discharge their gases of combustion into one chimney, whose axis is directly above the centre of the fire room. The steam from both boilers is delivered into an independent annular steam drum, surrounding the lower portion of the chimney, and by an arrangement of three stop valves this drum can be shut off at will, and the steam carried directly from the steam room of the boilers to the engines. No occasion, however, has ever arisen for thus excluding the steam from the drum. The boilers and drum were well felted and lagged.

The boiler shells were 11 feet in diameter, and 8 feet 8 inches in length, exclusive of the front connection projecting over the fire room. The back lower angle was beveled to a height of 2 feet 7½ inches in a horizontal distance of 18¼ inches. The cylindrical portion of the shell was 11/16 of an inch thick, and its seams were planed, butt-jointed and covered with double longitudinal straps 9/16 inch thick. The flat heads of the shells were ½ inch thick; their seams were planed, butt-jointed and covered with single straps ⅝ inch thick. All seams were double riveted and caulked. The gussets and stay plates were riveted to cylindrical shell and flat heads by angle iron 2½ by 2½ inches. The lower part of the front heads was ¾ of an inch thick; the back tube plate was 9/16 of an inch thick; the gusset plates were ½ inch thick; the stay plates were ¾ of an inch thick; and the stay rods in the steam room were

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* From the Journal of the Franklin Institute.

1⅜ inches in diameter, spaced 12 inches between centres. The rivets for the cylindrical shell were ⅞ inch in diameter, with 3 inches pitch; those for the flat heads were ⅞ inch in diameter, with 2¼ inches pitch, and those for the connection were ¾ inch diameter, with 1⅞ inches pitch.

Each boiler contained three cylindrical furnaces of 32 inches interior diameter and 6 feet 5⅝ inches extreme length. The grate surface in each furnace averaged 2·6144 feet wide and 6 feet 4½ inches long, making 16⅔ square feet. Each furnace was in three sections, separated by stiffening rings ½ inch thick and 37¾ inches outside diameter. Each section was composed of a single plate $\frac{7}{16}$ inch thick, with a planed seam butted and secured by an inside welt. Each furnace had a cast iron front, with an opening of 12 by 18 inches for the door. The horizontal distance between the centres of the furnaces, transversely was $34\frac{9}{16}$ inches. The least water space between the furnaces and boiler shell was 2⅛ inches, and between the furnaces 5⅜ inches. Manholes were made in all the spandrels above and below the furnaces.

Each boiler has a single back connection built in it, which connection is divided into three compartments by iron plates bolted in, so that each furnace has an independent back connection. The width of the connection, lengthwise the boiler, is 20⅝ inches in the clear; its top is a quadrantal arc of 16 inches radius, and a flat horizontal space of 4⅜ inches; its back is flat, and separated from the back of the boiler by a flat water space 6 inches wide, including thicknesses of metal. The sides of the back connection are concentric with the cylindrical shell of the boiler, and separated from it by a water space 6 inches wide, including thicknesses of metal. The flat water spaces have socket bolts at intervals of 7 inches between centres. The bottom of the connection contains the brick bridge walls, 6 inches high above the top of the grate bars, extending clear across the connection and supported on a cast iron base.

The tubes are horizontal fire tubes, returned from the back connection above the furnaces to the uptake, and they are arranged in two groups of ninety-five each. Each tube is of brass, seamless, 3 inches in outside diameter, 2·8 inches in inside diameter and 6 feet 4 11-16 inches long in the clear of the tube plates. The tubes are in eight rows vertically and twenty-four rows horizontally, the two outer tubes of the upper row being omitted. The distance between the centres of the tubes vertically is 4 inches, and horizontally 4⅜ inches. The total height occupied by the tubes, from the bottom of the tubes of the lower row to the top of the tubes of the upper row, is 35 inches. The vertical water space between the two groups of tubes is 12 inches wide in the clear.

The uptake is of sheet iron, lined with brick and bolted to the front of the boiler above the level of the furnaces.

The following are the principal dimensions of the boilers:

Number of boilers	2.
Diameter of boiler	11 feet.
Length of boiler, exclusive of uptake ...	8 feet 8 inches.
Number of furnaces in each boiler	3.
Interior diameter of furnaces	2 feet 8 inches.
Length of grate surface...	6 feet 4½ inches.
Mean breadth of grate surface	2·6144 feet.
Aggregate area of grate in both boilers ..	100 square feet.
Number of tubes in each boiler	190.
Outside diameter of tubes	3 inches.
Inside diameter of tubes	2·8 inches.
Length of tubes between the tube plates ...	6·390625 feet.
Diameter of the chimney	4 feet 6 inches.
Height of the chimney above the level of the grates	43 feet 6 inches.
Aggregate cross area over bridge walls for draught in both boilers	16·5000 sq. ft.
Aggregate cross area through tubes for draught in both boilers	16·2490 sq. ft.
Cross area of chimney	15·9042 sq. ft.
Aggregate area of heating surface in the furnaces of both boilers	174·1018 sq. ft.
Aggregate area of heating surface in the back connections of both boilers	212·1726 sq. ft.
Aggregate area of heating surface in the tubes of both boilers, calculated for inside diameter	1780·1256 sq. ft.
Aggregate area of heating surface in the uptakes of both boilers	47·6000 sq. ft.
Total area of heating surface in both boilers...	2214·0000 sq. ft.
Ratio of the grate surface to the cross area abeve the bridge walls	6·0606
Ratio of the grate surface to the cross area through the tubes	6·1542
Ratio of the grate surface to the cross area of the chimney	6·2876
Ratio of the heating surface to the grate surface	22·1400
Exterior diameter of the steam drum... ...	6 feet 6 inches.
Interior diameter of the steam drum	4 feet 6 inches.
Height of the steam drum	6 feet 3 inches.
Steam superheating surface in the steam drum	88·3575 sq. ft.
Greatest height of steam room in boilers ...	3 feet.
Aggregate steam room in shells of both boilers	360 cubic feet.
Steam room in the steam drum alone ...	108 cubic feet.
Total steam room	468 cubic feet.

SCREW.

There is one true screw, with the blades curved backwards on a radius of 37 feet for the forward edge. The screw is bronze, and of uniform length from hub to periphery.

Diameter of the screw	11·10 feet.
Diameter of the hub	1·75 feet.
Pitch (by measurement after screw was cast)	19·90 feet.
Length of the screw in the direction of its axis	1·4583 feet.
Number of blades	4.
Fraction used of the pitch	0·2931
Projected area of the blades on a plane at right angles to axis	27·6611 sq. ft.
Helicoidal area of the blades	37·8914 sq. ft.
Weight of the screw	4520 pounds.
Thickness of the blades of fillet of hub ...	4·4375 inches.
Thickness of the blades at periphery	0·375 inch.

TRIAL OF THE "DISPATCH" MADE IN CHESAPEAKE BAY BY A BOARD OF U. S. NAVAL ENGINEERS TO ASCERTAIN HER MAXIMUM SPEED, POWER AND CONSUMPTION OF COAL.

The following trial was made in Chesapeake Bay, by a Board of United States Naval Engineers, with the *Dispatch* at her deep load draught of water, to ascertain the maximum speed which could be permanently maintained in smooth water and uninfluenced by wind or current, burning anthracite in the condition in which it was delivered by the contractors, and with only the regular firemen of the engineer department of the vessel; also, to ascertain the power required for this speed, and the consumption of coal to produce it.

The trial continued nine consecutive hours, during which the vessel was run four and a half hours in a straight line in one direction, and then four and a half hours in the opposite direction, in order to neutralize the effects of wind and current. The water was smooth. The speed was noted by a taffrail log, by a patent log, and by the shore marks according to the Coast Survey chart. The wind was a gentle breeze, alternately on the port bow and starboard quarter.

Indicator diagrams were taken from each end of each cylinder every fifteen minutes, at which times there were noted in the appropriate columns of a tabular record, or log, the steam pressure in the boiler, the vacuum in the condenser, the height of the barometer, the number on the counter, and the temperatures of the air on deck and in the engine room, of the injection water, of the discharge water, and of the feed water in the hot well.

The throttle valve was kept wide open throughout, and the full throw of the Stephenson links were used.

The trial was begun with fresh, clean fires, of noted thickness, and ended with them in the same condition as nearly as could be judged. All the anthracite consumed and its refuse were weighed. The pressure of the steam and the height of the water in the boilers were left at the close of the trial the same as at its commencement.

The following are the mean results from all the observed data:

Date of the experiment ... ... January 14th, 1880.

VESSEL.

Vessel's draught of water, in feet and inches:	forward,	11·6
	mean,	12·2
	aft,	12·10
Vessel's greatest immersed transverse section in square feet, including projection of bilge keels		195·552
Vessel's displacement, in tons, including bilge keels		574·06
Vessel's external immersed or wetted surface, in square feet, including surface of bilge keels ...		5576·00

ENGINES.

Steam pressure in boilers, in pounds per square inch above the atmosphere	52·
Position of the throttle valve	Wide open.
Fraction of the stroke of the pistons completed when the steam was cut off	0·1166
Number of times the steam was expanded	5·7418
Fraction of the back stroke of the piston completed when the steam was cushioned	0·8333
Vacuum in the condenser, in inches of mercury, ...	25·50
Pressure in the condenser, in pounds, per square inch above zero	2·076
Height of the barometer	29·73
Number of revolutions made per minute by the circulating pump	150·
Number of double strokes made per minute by the pistons	64·5333

TEMPERATURES.

Temperature, in degrees Fahrenheit, of the air on deck	44·0
Temperature, in degrees Fahrenheit, of the injection water	34·5
Temperature, in degrees Fahrenheit, of the discharge water	73·0
Temperature, in degrees Fahrenheit, of the feed water	100·0
Temperature, in degrees Fahrenheit, of the air in the engine room	82·0

(*To be continued.*)

NEW SHIPS BUILDING.

THERE are about 60 ships at present in the course of construction in the Wear shipyards, and all the yards, marine engine works and rolling mills have been kept briskly employed. The foundry on the Tyne are also very busy with marine castings.

The North of England Shipbuilding Company have nearly completed their first steamer, a vessel of 3,000 tons dead weight capacity. She will be launched in a week or two. One of the largest steamers ever built in the Wear, named the *Mexican*, for the Union Steamship Company's Cape Mail service, will be ready for launching in a few weeks, and several other vessels are nearly ready for launching on the Wear.

The extensive dock and slipway at North Shields, formerly belonging to Mr. George Fawcus have been taken by Messrs. J. Hepple and Co., of South Shields, steam-tug builders on the Tyne. Messrs. T. and W. Smith's dock on the Tyne is now fully employed. They have on hand three new screw steamers in various stages of progress. Messrs. Swan and Hunter, of Wallsend, have three vessels in progress. Messrs. Schlesinger, Davis and Co.'s yard at Wallsend is also well stocked with new work. There are four vessels in progress, and preparations are being made for a fifth. Both the Jarrow and Howdon yards of the Palmer Shipbuilding and Iron Company show the same activity which has characterised them since the re-opening of the north side establishment. Vessels are there in all stages of construction—some just commenced, others framed, plated, and ready for launching. The fitting out of two large steamers is proceeding with all haste at the Jarrow works.

The British Steamship Owners' Protective Association at Sunderland has taken action to afford assistance to individual Shipowners in cases where the action of the Board of Trade is deemed either unjust or excessive. The members consist of Sunderland, South Shields, and Newcastle Shipowners.

Shipbuilding at South Shields continues very brisk. Five new steamers are being constructed, and will shortly be launched, and one is just finished, namely, the *Wilberforce* (s). Extensive engine works are about to be erected at the south-west end of South Shields, where it is anticipated a very large business will be done. The yard of Mr. J. T. Eltringham is at present full of work.

Amongst the vessels in South Shields Docks now undergoing repairs is the screw steamer *Chevy Chase*, in Messrs. T. Metcalfe and Co.'s dock, and they are also expecting the barque *Olive-branch* in a few days. The Middle Dock Company are expecting the barque *Martha Jackson* to be scraped and painted, Messrs. J. Young Co., of South Shields, have in hand the steamship *Atlantic*. Messrs. H. S. Edwards and Sons, South Shields, have the screw steamers *Holmside*, *Ardangorm*, *Loch Leven*, and *C. W. Anderson* in dock, all undergoing repairs. Messrs. J. T. Eltringham and Co., South Shields, have three new steamtugs building, and two fitting out.

OCEAN TEA RACE.

THE steamship *Stirling Castle*, belonging to Messrs. Thomas Skinner & Co., was docked at the Royal Albert Docks at 4 p.m. on June 22nd, having passed the lightship at the mouth of the Yangtse, 42 miles from Shanghai, at 3.45 a.m. on May 23rd, making the run, including all detention, in 29 days 22 hours 15 minutes, or steaming time 27 days 23 hours 15 minutes, which beats the best passage on record by about 10 days. The distance from Shanghai to London is about 12,000 miles. The cargo, which was a little short of 6,000 tons, and the largest ever brought to this country in one vessel, was worth over one million pounds sterling, and was discharged in the unprecedented short time of 30 hours, which reflects the greatest credit upon the Royal Albert Docks Co.

This is the third steamer which has been added to the celebrated Castle Line of vessels during the past 13 months, the others being named the *Bothwell Castle* and the *Minard Castle* respectively, all of which have been built to the specification and under the superintendance of Mr. A. Beldam, consulting engineer, 77, Gracechurch-street.

Since the celebrated run of the *Loudoun Castle*, six years back, the opposition Glen Line of steamers have held the "ribbons," having always landed the first season's tea, but this year the *Stirling Castle*, having shown such superiority over any other steamer in the tea trade, we contemplate it will test the brain of both shipowners and engineers to out do her performance, which has been decidedly better than that of any other ocean going steamer afloat.

The general dimensions of the vessel are,—length 430 ft., beam 50 ft., depth moulded 32 ft. 9 in. She is fitted with the three cylinder type of compound engines, the one high pressure, being 62 in. diameter, and two low pressure, 90 in. diameter, the stroke of each being 5 ft. 6 in.; diameter of crank shaft 43 in. There are six large double-ended boilers, containing in all 36 furnaces, also an auxiliary boiler; the safety valves are loaded to a working pressure of 100 lb. on the square inch; the propeller is 4-bladed, 22 ft. 6 in. diameter and 31 ft. stroke, and is manufactured of manganese bronzes which is a departure from the material usually used in propellers.

STEEL ROPES.

IN the launching of vessels in the North of England, an interesting experiment with steel ropes was lately made. It has been the custom hitherto to use, for the purpose of checking the speed of the vessel after leaving the ways and of bringing her up, heavy chain cables. In launching the fine steamer, *Hypatia*, from their shipyard at West Hartlepool, Messrs. Edward Withy & Co. conceived the idea of using steel ropes instead, and successfully carried out that idea. Practically, there was no difference between the method of use of the cables and that of the rope, except the substitution. The steel ropes used were of Bullivant's manufacture, and of about 6 in. circumference, formed to bear a high breaking strain. The weight of those used was about three tons, whilst the usual weight of the chain cables attached previously by the firm to similar sized vessels to that launched has been about 21 or 22 tons. The vessel was of over 2,000 tons gross register, and thus the system was fairly tested, and success attended it. The reason for the change has been that of the saving of the heavy cost of moving, placing, and replacing the weighty cables, which have had to be received and fixed in their places by manual labour, and the cost of this in the dealing with some twenty tons of cable is large. It is evident that there is still attainable in the launching, as well as probably in the building of vessels, very great economy, and in the North, where cargo vessels of good size, but of a size that is moderate to that of the vessels launched on the Clyde, there is a favourable field for the attempt. In the shipyards of the North there has not been as yet so full a use of machinery as there might have been, but the tendency is towards a greater use of it, and also towards the use of other expedients such as that that has been named to lessen the cost of some of the incidentals of shipbuilding.

DIVING APPLIANCES.

*Improved Appliances for Working under Water, or in Irrespirable Gases.**

By Mr. W. A. Gorman, of London.

HISTORY OF DIVING.—In bringing before the members of this Institution the following paper, the author does not intend describing at any length the early history of diving.† From the earliest times divers have been employed in fishing for pearls, corals, and sponges, and have been accustomed, before descending, to place a piece of sponge soaked in oil, between their teeth. This is said to have enabled some of the most hardy to remain at least six minutes under water.

The records of the earlier attempts to provide some artificial supply of air to divers under water are unsatisfactory. Roger Bacon (A. D. 1240) was supposed to have originated a machine for working under water. The invention of the diving bell is generally assigned to the sixteenth century. The first account of its use in Europe is that of Tasnier, who relates that in 1538, at Toledo, in Spain, he saw two Greeks, in the presence of Charles V., let themselves down under water in a large inverted kettle without being wet.

Lord Bacon, in his "Novum Organum" (A. D. 1600), describes the primitive method adopted in his time, in which there was no mode of replenishing the air in the inverted vessel, or bell, whilst under water. In 1632 Richard Norwood took out a patent for a special means to dive into the sea.

Borelli, in 1669, constructed a copper vessel 2 ft. in diameter, with glass fixed before the face of the diver; this he termed a "vesica." It was worn as a helmet, and securely attached to a dress of goatskin. Within the "vesica" were pipes, by means of which a circulation of air was contrived. An air-pump was affixed to his side, by which the diver was said to condense or rarefy the air within the "vesica," so as to make himself heavier or lighter, on the same principle as the air-bladder of fishes. Artificial webbing was also supplied to the feet, to enable him to tread the water.

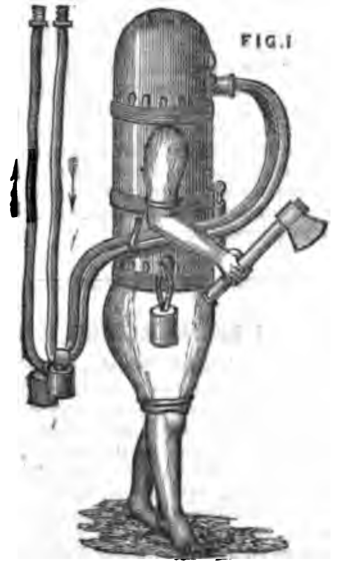


FIG. 1

In the latter part of the seventeenth century the diving bell came largely into use. About 1680 a mania arose for undertaking submarine exploration, and companies were formed for that purpose; but from imperfect appliances they were unable to reap profitable results.

About the year 1700 Dr. Edmund Halley devoted much time to subaqueous experiments, and in 1716 he read a paper before the Royal Society entitled "The Art of Living under Water." In this paper he says, "When there has been occasion to continue long at the bottom of the sea, some have contrived double flexible pipes to circulate air down into a cavity, enclosing the diver with armour, to bear off the pressure of water, and give leave to his breast to dilate upon inspiration, the fresh air being forced down one of the pipes, with bellows, or otherwise, and returning by the other of them, not unlike an artery or vein. This has been found sufficient for small depths, 12 ft. or 15 ft.; but when the depth surpasses three fathoms, experience teaches us that this method becomes impracticable, for though the pipes and rest of the apparatus may be contrived to perform their office duly, yet the water, its weight being now become considerable, does so closely clasp the limbs that are bare, or covered with flexible covering, that it obstructs the circulation."

To remedy these inconveniences he turned his attention to the diving bell. His contrivance consisted of a truncated cone of wood, 3 ft. diameter at the top, and 5 ft. at the bottom, and containing 60 cubic feet. In the top was placed a strong glass to give light, and a cock to let out the vitiated air; the bell was coated with lead and weighted, that it might sink steadily; when below it was supplied with air by two barrels of thirty-six gallons each, which were alternately lowered and raised. He states that he remained one hour and thirty minutes under water, at a depth of ten fathoms.

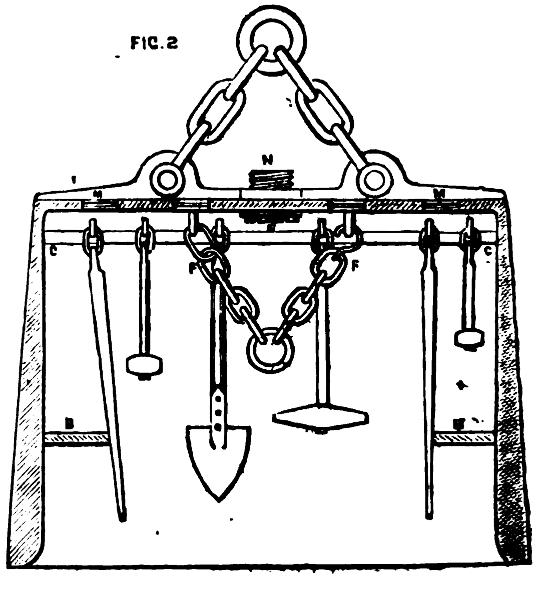
In 1721 he described to the Royal Society a method by which the diver could leave the bell. He used pipes 40 ft. in length, made with spiral brass wire inside; one end was fixed in the bell, and the other to a cock which opened into the diver's cap. This was made of lead, weighing 56 lb., and he also wore a girdle of the same weight, and clogs of lead weighing 12 lb. each.

About the same date, 1716, when Dr. Halley read his first paper to the Royal Society, John Lethbridge invented an air reservoir, made of wainscot, perfectly round and 6 ft. long, 2 ft. 6 in. in diameter at the head, and 1 ft. 6 in. at the foot. He compressed air into this with a pair of bellows, and then lowered it with himself under water, where he remained 34 minutes. Numerous inventors followed in his track.

Smeaton, in 1779, first employed the diving bell for civil engineering operations, in repairing the bridge at Hexham, Northumberland. The apparatus was an oblong wooden box, 4 ft. high, 2 ft. wide, and 3 ft. 6 in. long. It was supplied with air by a pump fixed on the surface.

Soon after the construction of the new dock at Ramsgate, in 1784, Smeaton employed an improved diving bell weighing half a ton; two men worked in it, and were provided with a constant supply of fresh air through flexible pipes, by means of a force pump placed in a lighter which floated over them. Smeaton appears to be the first person who used the air pump to force a supply of fresh air to the divers, in the bell under water.

FIG. 2



A diving dress was invented in 1798 by (Fig. 1) Kleingert, of Breslau, which consisted of strong tin-plate armour in the form of a cylinder encasing the diver's head and body, with a leather jacket and strong leather drawers. These were made waterproof, and joined by brass hoops around the metal armour, so that the diver was relieved from the pressure of the water except on the legs and arms. He inhaled the air from the surface through one pipe, and the vitiated air was carried to the surface by another. A diver could not with this apparatus descend to greater depths than 20 ft.

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* Paper read before the Institution of Mechanical Engineers.

† Those who take an interest in the subject are referred to Lord Bacon's "Novum Organum;" "Philosophical Transactions" from the time of Halley, 1678; "The History of Inventions," by Beckman; Boyle's "Experimental Philosophy:" the article on Diving in 'The Encyclopædia Britanica;" and Messrs. Siebe and Gorman's book on "Diving."

About the same date Messrs. John & William Braithwaite constructed a diving apparatus, with which they carried out several successful operations. In 1805 they recovered £75,000 in dollars from the East Indiaman Earl of Abergavenny.

Rennie, whilst occupied on the works of Ramsgate Harbour, 1813, made considerable improvements in the diving bell; he designed and constructed a diving bell of cast-iron (Fig. 2) 6 ft. high, 4 ft. 6 in. wide, and 6 ft. long, with one side a little heavier than the other, so that it should not float quite level, and thus more readily allow the vitiated air to escape. At the top of the bell six thick bull's-eyes of glass were fixed to admit light. In the centre of the top was a circular hole, in which a brass lining was firmly fixed. To the under side of this was attached the air valve on a brass grating (Fig. 3). The valve itself was simply a disc of strong leather. A nozzle was fixed to the top of the bell above the valve, and to this was screwed a water-tight leather hose 2½ in. in diameter connected to the air pump, which was constantly worked by a sufficient number of men. Inside the top of the bell were strong lugs to which were attached chains (FF Fig. 2) for suspending stones or other material. The bell was fitted with seats and a rail for hanging the various tools used by the men; it was slung by stout chains from a double purchase crab fixed on a truck, which could travel along the gantry: the total weight was five tons. Rennie used this diving bell with great success in the numerous harbour and other works with which he was associated.

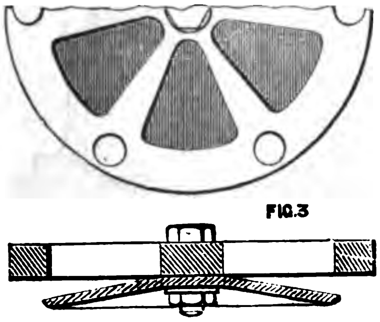
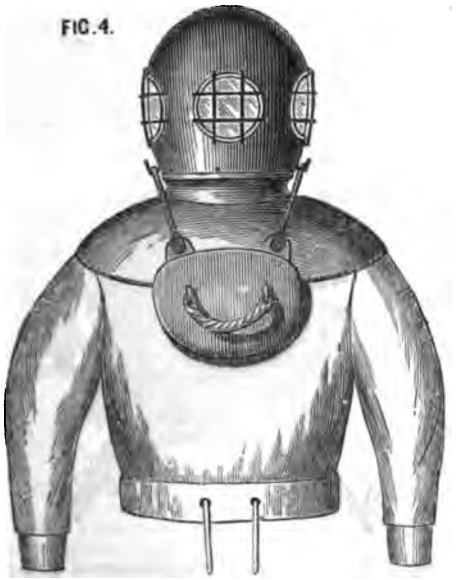


FIG.3

FIG.4.



The Open Diving Dress.—In the year 1828 or 1829, the late Mr. Augustus Siebe, A.I.C.E., the founder of the author's firm, was applied to by Messrs. Deane to assist them in the construction of a diving dress, afterwards known as the open-helmet diving dress. The helmet was made of copper with a screw lens in front (Fig. 4), and a metal elbow rivetted on the back of the head-piece, to connect the air pipe with the pumps, the head-piece and breast-plate being in one. To the breast-plate was attached a canvas jacket, which, with the aid of two lead weights, kept the helmet fixed upon the shoulders. Boots with lead soles, weighing 12 lb. each, were worn, and also a waterproof dress fastened round the neck, over which were placed the helmet and jacket. The air escaped into the water from underneath the outer canvas jacket, and the water reached within a few inches of the diver's mouth, so that he had to work in a vertical position. The air pumps had three cylinders, 3 in. diameter, 9 in. stroke. Even at the present day many of the coast divers use this form of dress.

FIG.5

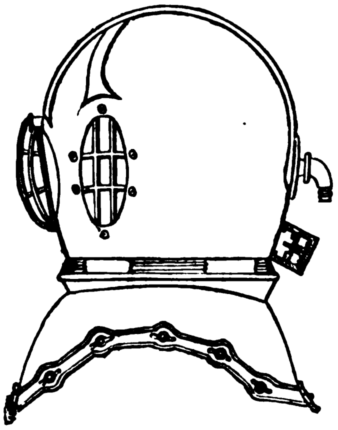


FIG.8

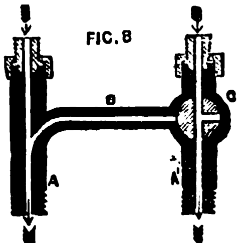
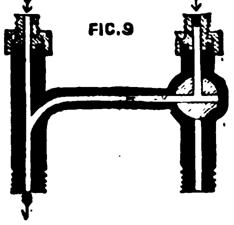


FIG.9



The Close Diving Dress.—About 1839, when engaged at the wreck of the *Royal George*, Mr. Siebe, observing the danger attending the use of the open helmet, introduced his invention of the close helmet (Fig. 5), fitted with inlet and outlet valves, and with a segmental neck screw, to remove the head-piece by one-eighth of a turn. The waterproof dress was fastened to the metal collar by screws and brass bands. Colonel Pasley, R. E. (afterwards Major-General Sir C. Pasley) at once ordered the Royal Engineer divers to be equipped with this dress and helmet; and the operations at the wreck, owing to this great improvement, were carried on with much greater rapidity, and without accident.

The above brief description of diving apparatus in its primitive form will be sufficient to show the progress made up to a recent date.

Modern Apparatus.—This apparatus (Figs. 6 & 7) is a very perfect one, combining a high degree of safety with comfort for the diver. The air pump (Fig. 6) is capable of compressing air to a pressure of 240 lb. per square inch, and consists of two vertical double-action gun-metal cylinders (PP), securely fixed to a bed-plate of gun-metal, which is bolted on the base of two side standards (AA), forming an iron framing to carry the crank-shaft (B). Each piston (Fig. 7) is constructed of two inverted cups of leather (LL), with leather packing placed between, and the whole is secured by two cast-iron piston plates (MM) fitted to the piston rod inside the leather cups, and pressed together by a nut. Grooves are formed in the periphery of the piston plates, to contain expanding springs, which, pressing against the inner side of the leather cups, keep them in close contact with the cylinders, and thus maintain the piston in a perfectly air-tight condition. Each cylinder cover has an oil tap for lubrication.

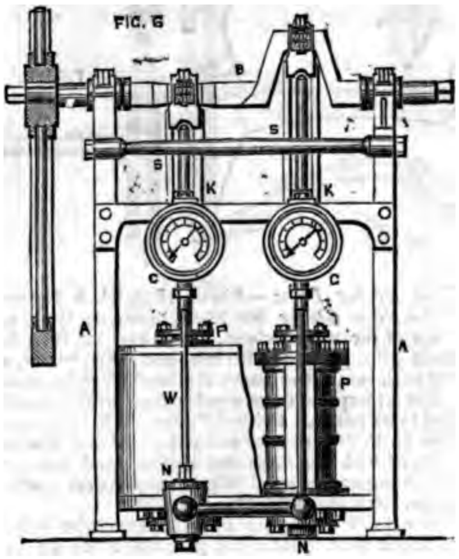
The piston rods pass through glands (H) packed with turned leather washers, and are extended so as to work in guides (KK Fig. 6). Double connecting slings (SS) with gun-metal bearings, connect the piston rods to the crank-pins. Inlet and outlet valves (I & O Fig. 7) are fixed in the covers of each cylinder, and also in the baseplate. Spindle valves are used, faced with leather, and with gun-metal seatings, to which the val veis kept by a spiral spring. The top and bottom outlet valves are connected by passages cast on the cylinders, and leading to the air-delivery nozzle (N). The cylinders are surrounded by a copper cooling cistern (W Fig. 6).

Pressure gauges show (GG) the depth and pressure at which the diver is working, and are also used for testing the air pipes. Each gauge is marked off to represent the pressure in pounds per square inch at given depths of water, as given by the following Table:—

Depth.	Pressure.	Depth.	Pressure.
ft.	Pounds per Square Inch.	ft.	Pounds per Square Inch.
20	8·68	120	52·08
30	13·02	130	56·42
40	17·36	140*	60·76
50	21·70	150	65·10
60	26·04	160	69·44
70	30·38	170	73·78
80	34·72	180	78·12
90	39·06	190	82·46
100	43·40	204†	88·64
110	47·74		

The flywheel and winch handles, fitted on the crank-axle, are made to be easily removed, and the whole pump is securely fitted in a strong teak case.

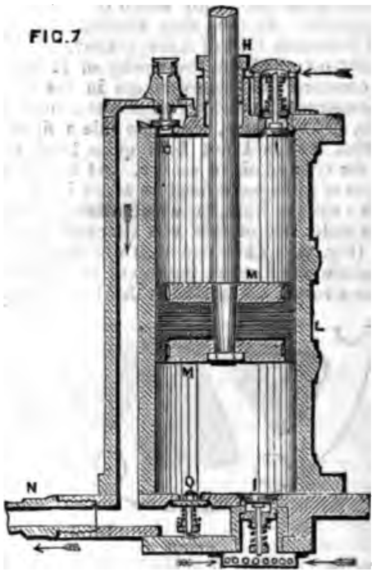
FIG. 6



The air-distributing arrangement, by which the air can be transmitted to one or two divers as occasion may require, is as follows. The two outlet nozzles (AA Fig. 8) are connected by a cross branch pipe (B), and a three-way cock (C) is fixed at the junction of the pipe (B) with a nozzle (A). The position oi this cock, when supplying air from both cylinders to one diver, is shown in Fig. 9, while Fig. 8 shows the position when two divers are to be supplied, each being in connection with one cylinder. If at any time the pump is supplying one diver, and it is necessary to send down the second diver to his assistance, it is only necessary to turn the lever of the cock (C) round to the position marked "two divers," and work the pump faster. The great advantage of this pump is that it can supply air to two divers independently at different depths. Two divers can work from it to a depth of ft., or one diver to a much greater depth.

The improved helmet (Figs. 10 & 11) is made of tinned and planished copper and consists of two parts, the breast plate and the head-piece. The breast-plate is so constructed that the diver has free use of his arms, and can reach over the head-piece. It has a segmental neckring (R), so that the head-piece can be removed by one-eighth of a turn, and has a brass band (S) at the bottom, with twelve screw studs, to which are fitted four brass plates, fastened by wing-nuts, thus forming the junction with the waterproof dress. A is an air passage provided for conducting the air supply over each lens, so as to prevent the diver's breath from condensing upon the glass. B is a nozzle to which the air pipe is connected, and inside which is placed an inlet valve; in case of accident to the air pipe the air pressure inside would
close this valve, and thus prevent the water from en
helmet. D is the front lens which can be can unsc
that the diver can converse without being undressed,
the side lens. O is the outlet valve provided for the
vitiated air into the water. G is the stud for securing th
and H a regulating tap by means of which the diver
late his supply of air without giving a signal.

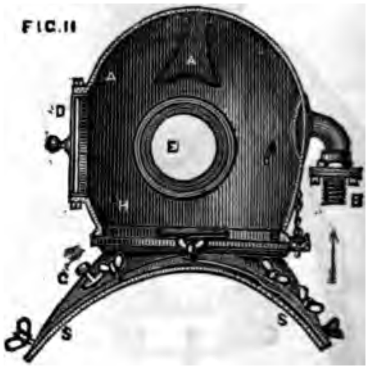
FIG. 7



The outlet valve (Fig. 12) is placed at the side of the
and within reach of the diver; it is a metal cone valve, o
is screwed a metal cap (A) with small holes drilled in it
the air to escape into thewater The valve spindle is
position by a hard drawn copper wire spring. There is
brass cap (B) screwed on the first one, and having a smal
In this the diver can insert his finger, and press down
spindle, so as to confine the air, and thus inflate his
rise to the surface. The valve has a small metal cha
carried up a short distance, so that the opening into t
is 4 in. above the valve.

The waterproof dress is made of strong tanned twil
india-rubber lining between the thicknesses of the materi
mineralized india-rubber collar and cuffs. The boots
soles, weighing 14 lbs. each. At the front and back
weights, 40 lbs. each. An air pipe, with spiral wire em
it, and joints fitted to connect up to any desired lengths
in water-tight case, a leather belt and pipe holder, and
suit of flannels, complete the equipment. For deep wate
wear a body guard, to keep off the pressure.

FIG. 11



Experience in Working.—Some special cases of diving
apparatus may be mentioned. In the recovery of trea
the *Hamilla Mitchell*, sunk off Shanghai, in a depth
the diver, Robert Ridyard, worked for five consecutive
to six hours each day, recovering £40,000 in dollars. Th
was used constantly day and night at the raising of the

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* Practical limit of diving.

† The last figure is the greatest depth to which (to the author's knowledge) a diver has ever descended.

on an average, eight divers were working together in a strong tide and amongst wreckage, but not a single accident occurred.

When the news reached England that H.M.S. *Doterel* was blown up, the Admiralty at once telegraphed to the ships of war on the station to proceed to the scene of the disaster, as each of Her Majesty's ships carries a seaman diver, and also an artificer diver.

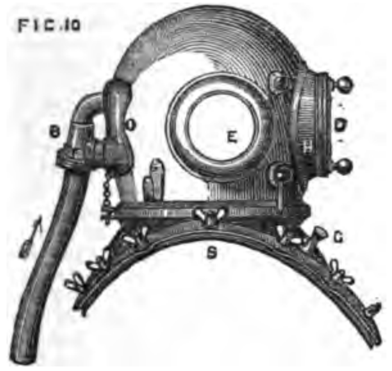


FIG.10

H.M.S. *Garnet* was the first vessel to arrive at Sandy Point. Lieutenant Stanley Dean Pitt, R.N., volunteered to accompany George Hunt, artificer diver, in making a careful survey of the wreck, which was lying in twelve fathoms of water, the result being positive proof that the boilers had not caused the explosion, as they were found in perfect condition. The author considers that the apparatus he has described was, in this particular case, of great service to the engineering world, to say nothing of the importance to the country, as the whole of the armament and other valuable property were recovered.

For engineering works the apparatus is in use at the present time to a considerable extent, as at Colombo, Port Elizabeth, Madras, and many other harbours. The average number of hours for a diver to work in water, say, to 60 ft. depth, is four. Their pay depends upon their capabilities; but in this country the average rate is £4 10s. per week for masons, £4 for carpenters, and £3 10s. for labourers. In wrecking operations the divers work at a salvage scale, according to the depth, and, as a rule, earn very good wages.

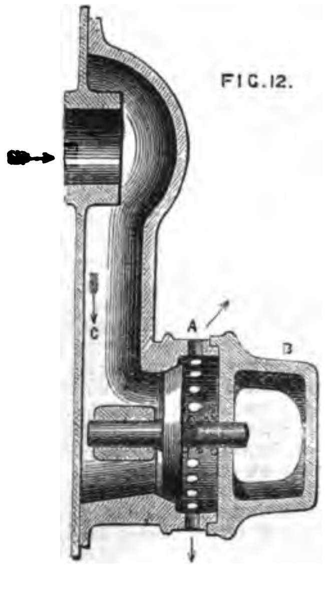


FIG.12.

As so many various handicrafts are required for submarine works, the author's firm have erected a diving tank in their works, where men are trained, and also experiments carried out. The selection of divers requires much care. Steady habits are essential, and from long experience it is found that men of sanguineous temperament are unfit to bear great pressure, while a man slightly built, but muscular, although he may seemingly be weak in lungs, often turns out a first-class diver, and improves in health and strength. Among the many purposes for which the diver is required may be mentioned the following: The repairs and inspection of dock gates, sluices, bridge foundations, &c.; the removing of pumps and other appliances in shafts; the repair of well pumps when under water; the cleaning of iron ships' bottoms, and repairing of leaks; the examining or repairing of fouled or damaged screws, &c.; the sinking of cylinders for piers and bridges; the laying of pipes for gas and water in rivers or harbours; torpedo service; and lastly, fishing for sponge, pearl, coral, and amber.

Appliances for Working in Irrespirable Gases.—The Fleuss apparatus represents a great improvement in this direction. It is self-contained and entirely independent of any communication with the outer atmosphere, thus enabling the wearer to breathe with safety in the most noxious gases, to walk any distance, and to explore the most intricate turnings of a mine with perfect freedom of action. The principle of the apparatus is that the wearer breathes the same air over and over again, the carbonic acid being absorbed from it after each expiration, and at the same time the requisite amount of oxygen restored; thus rendering it pure and fit to be again inhaled into the lungs.

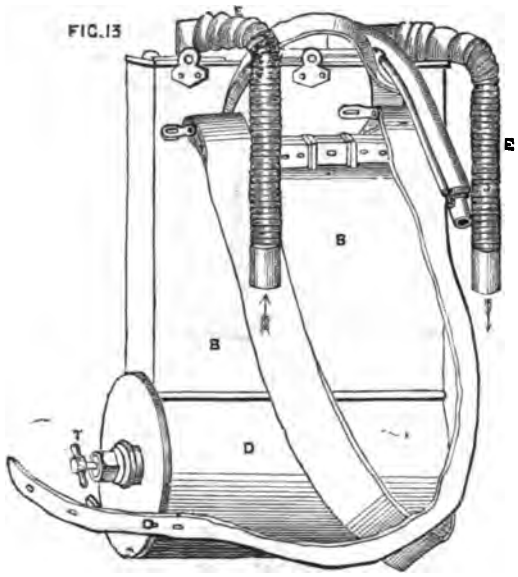


FIG.13

The apparatus (Fig. 13) consists of a strong copper cylinder (D) 6½ in. in diameter, and 12 in. long, with domed ends, and capable of containing 4 cubic feet of oxygen, at 16 atmospheres pressure; this being sufficient for four hours' respiration. Above the cylinder (D) is attached a square metal box (B) 12 in. by 12 in. by 4in.; this contains the carbonic acid filter, which is a box of vulcanite divided into four compartments by vertical diaphragms, in such a manner that the exhaled breath of the wearer is made to pass twice up and down through the vessel, before it is in a position to be again inhaled. This box is fitted with small cubes of india-rubber sponge saturated with a thick pasty solution of caustic soda. The exhaled air, being finely divided as it passes through the interstices of the sponge, and coming in contact with a very extended surface of caustic alkali, becomes thoroughly cleansed of all the objectionable products of respiration.

A flat bag (G Fig. 14) of vulcanised india-rubber, 12 in. by 15 in., is strapped on in front of the wearer; into this the exhaled air passes from the filter, by means of a tube of india-rubber. The bag is also in communication with the oxygen chamber, (D), and the supply of oxygen to the bag (G) is regulated by a jamb screw-valve (T Fig. 13) under the control of the wearer. The mask (A Fig. 15) is made to fit air-tight to the face of the wearer, and is held in place by straps buckled at the back of the head. A band of rubber is made to cover the ears, and the eyes are protected by glass, when it is necessary to go into smoke or gases that would hurt them. The mask is provided with a pair of flexible tubes (F) with valves, the one for exhaling being in communication with the filter, and the one for inhaling being connected to the air bag. The slightest effort of inspiration brings the revivified air freely to the lungs of the wearer. The whole apparatus weighs 26 lb., and can be adjusted in two minutes.

The author considers this apparatus particularly adapted for the use of coal mines, or when men have to deal with noxious gases. Mr. Fleuss has remained in the densest smoke, as also in a glass chamber charged with carbonic acid, for a considerable time. His apparatus was regularly used for some time at the Westminster Aquarium, and also more recently at the re-opening of the Maudlin seam of the Seaham colliery, after the fatal explosion of September, 1880. The author has to thank Mr. Fleuss for his kind permission to bring his improvements before the notice of the Institution.

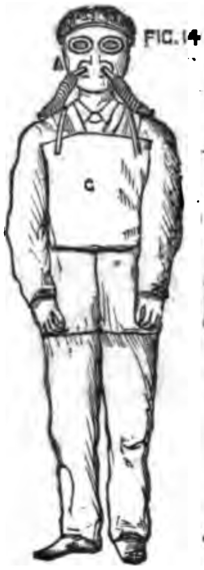


FIG. 14

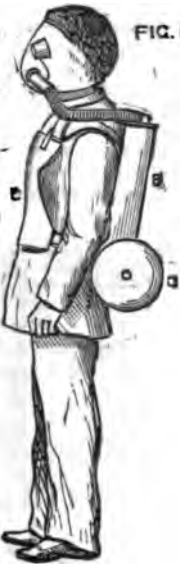


FIG. 15

In conclusion, the author may allude to the use of the electric light for submarine purposes. It is really the only light which can be of use to the diver, and of late the author has made some very satisfactory trials of it. The telephone has not been fully tested in practice, the divers preferring their ordinary signal line, or communicating by a slate.

OBITUARY.

SCOTT RUSSELL.—We regret to announce the death of Mr. Scott Russell, the engineer, which took place on Thursday morning, June 8th, at Ventnor, in the Isle of Wight, in the 75th year of his age. John Scott Russell, according to *Engineering*, was the eldest son of the Rev. David Russell, a Scotch clergyman. He was born in the Vale of Clyde in the year 1808, and was originally destined for the Church. His great predilection for mechanics and other natural sciences induced his father to let him enter a workshop, to learn the handicraft of the profession of an engineer. He subsequently studied at the Universities of Edinburgh, St. Andrews and Glasgow, and graduated at the latter at the early age of 16. He had attained to such a proficiency in the knowledge of the natural sciences that on the death of Sir John Leslie, Professor of Natural Philosophy in Edinburgh, in 1832, the young Scott Russell, though then only 24 years of age, was elected to fill the vacancy temporarily, pending the election of a permanent professor. About this time he commenced his famous researches into the nature of waves, with the view to improving the forms of vessels. His first paper on this subject was read before the British Association in 1835. The interest created by this paper was so great that a committee was appointed by the association to carry on the experiment at their expense. The committee consisted of Sir John Robinson, secretary of the Royal Society of Edinburgh, and of Mr. Scott Russell himself as reporter. The report, which is of a most exhaustive character, is published in the seventh volume of the "Transactions of the British Association." Mr. Scott Russell discovered during these researches the existence of the wave of translation and developed the wave line system of construction of ships in connection with which his name is now so widely known. In 1837 he read a paper before the Royal Society of Edinburgh, of which institution he had some years previously been elected a member, "On the Laws by which water opposes resistance to the motion of floating bodies." For this paper he received the large gold medal of the society and was elected a member of its council. The first vessel on the wave system was called the *Wave*, and was built in 1835; it was followed in 1836 by the *Scott Russell*, and in 1839 by the *Flambeau* and *Fire King*. Mr. Scott Russell was employed at this time as manager of the large shipbuilding establishment at Greenock, now owned by Messrs. Caird & Co. In this capacity he succeeded in having his system employed in the construction of the new fleet of the West India Royal Mail Company, and four of the largest and fastest of these vessels—viz., the *Teviot*, the *Tay*, the *Clyde*, and the *Tweed*—were built and designed for himself. In 1844 Mr. Scott Russell removed to London. In 1847 he was elected a Fellow of the Royal Society and Member of the Institution of Civil Engineers, of which body he was for some time a vice-president. He for a short time occupied the post of secretary to the Society of Arts, which place he resigned to become joint secretary with Sir Stafford Northcote of the Great Exhibition of 1851. He was, in fact, one of the three original promoters of the exhibition, and under the direction of the late Prince Consort took a leading part in organizing it. Mr. Scott Russell was for many years known as a shipbuilder on the Thames. The most important work he ever constructed was the *Great Eastern* steamship, which he contracted to build for a company of which the late Mr. Brunel was the engineer. The *Great Eastern*, whatever may have been her commercial failings, was undoubtedly a triumph of technical skill. She was built on the wave-line system of shape, and was constructed on the longitudinal double skin principle, which also was invented by Mr. Scott Russell. It is not necessary now to refer to this ship in any detail. In spite of the recent advances made in the size of vessels, the *Great Eastern*, which was built more than a quarter of a century ago, remains much the largest ship in existence, as also one of the strongest and lightest built in proportion to tonnage. The paddle engines and boilers of this vessel were also made and designed by Mr. Scott Russell. Mr. Scott Russell was one of the earliest and most active advocates of ironclad men-of-war, and he has the merit of having been the joint designer of our first sea-going armoured frigate, the *Warrior*. His last work in naval construction was the steamer on the Lake of Constance, which carries railway trains between the termini of the German and Swiss railway systems on the opposite shores of the lake. Mr. Scott Russell was one of the founders of the Institution of Naval Architects, and was one of its vice-presidents from the date of its constitution down to the day of his death. Though perhaps best known as a naval architect, Mr. Scott Russell was an active worker in other fields of engineering science. In early life he took a great interest in steam locomotion on ordinary roads, and while at Greenock he constructed a steam coach which ran for some time successfully between Greenock and Paisley. The springs of this steam carriage and the manner in which the machinery adapted itself to the inequalities of the road were triumphs of ingenuity. His greatest engineering work was without doubt the vast dome of the Vienna Exhibition of 1873. This dome is, among roofs, what the *Great Eastern* is to ships, its clear span of 360 feet being by far the largest in the world. It will be probably the most enduring monument of its designer's fame and ability. The last engineering work which Mr. Scott Russell ever designed was a high-level bridge to cross the Thames below London Bridge. It was intended to cross the river with a span of 1,000 feet and to allow of a passage beneath it for the largest ships. Mr. Scott Russell contributed largely to the literature of his profession. In addition to the numerous papers which he read before scientific societies, he wrote the section on the steam-engine and steam navigation in a former edition of the *Encyclopædia Britannica*. He was also the author of the large work on naval architecture entitled the *Modern System of Naval Architecture for Commerce and War*, and of a work on *Systematic Technical Education for the English People*. Mr. Scott Russell was one of the last links connecting our time with the great era of engineering at the early part of the century, and his loss cannot but be keenly felt by all who knew him.

THE steamship *Alaska* arrived at Queenstown on Tuesday, June 6, from New York having completed the journey for the first time on record in less than a week. She left Sandy Hook on Tuesday. May 30, at 5.40 p.m., and reached Queenstown on Tuesday, June 6, at 8.4 a.m. From this must be deducted the difference of time between Queenstown and New York, giving as the result 6 days 22 hours 2 minutes.

THE ITALIAN IRONCLAD DANDOLO.

THE new twin-screw double-turret vessel *Dandolo*, belonging to the Royal Italian Navy, has just completed the trials of the machinery previous to joining the squadron in the Mediterranean. Excepting the omission of the internal torpedo dock, she resembles the sister ship *Duilio* in her general arrangement, but she has considerably surpassed her in speed. The *Dandolo* was built at the Royal Naval Arsenal at Spezia, under the supervision of Director Borghi, at whose suggestion the whole of the bow plating is worked flush, instead of the plates overlapping as usual. The length of the vessel is 337 ft. 8 in., the breadth 62 ft. 3½ in; the mean draught at the trials with armament on board was 28 ft. 9 in., giving a total displacement of 11,225 tons. The battery is heavily armoured, and is placed in the middle of the vessel; the two turrets rise above the weather deck, and are placed diagonally in the battery, so as to enable all four guns to be fired fore and aft. The armour of the turrets is impenetrable to all except the heaviest modern artillery. Each turret contains two 100-ton Armstrong guns made at Elswick, having a bore 17·72 inches, throwing a shot 2,018 lb., with a *maximum* of 511 lb., of powder, the ordinary charge being 355 lb. The turrets and guns are moved and worked by a complete system of hydraulic gear made at Elswick. The loading is also done by the same means, the rammers being below the weather deck and arranged to enter the gun when the muzzles are depressed for the purpose. Between the turrets is situated the mast, which really assumes the function of a look-out tower, as there are no sails.

The vessel is fitted with Forrester's steam steering gear, as well as very powerful hand-steering gear, and has a beautiful self-acting arrangement, designed and fitted by the Italian constructors, for checking and holding the tiller; in case of the chains breaking the tiller would lock itself amidships and remain at rest till the new chain was reeved.

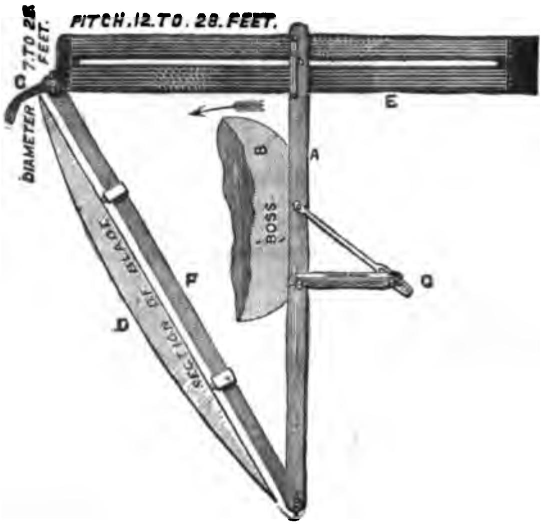
The *Dandolo* carries four large steam launches, and eight other boats, all hung upon hinged davits which are worked from the steam capstan, and which will hoist them right in board. The *Dandolo* is propelled by twin screws worked by two independent pairs of engines, which were contracted to indicate a *maximum* power of 7,500 horses. These engines, together with the pumping and blowing engines, were constructed by Messrs. Maudslay, Sons, & Field, of London. They are the first compound engines which were ordered for the Royal Italian Marine, though they have been awaiting the completion of the ship at Spezia since 1876, when they were brought out in the Royal transport *Europa*. Each set of engines is placed in a separate water-tight compartment, one at each side of the vessel; instead of being side by side they are situate one in advance of the other, the alternate spaces being occupied by the magazines, which are placed immediately below the turrets. Each pair of engines has one high-pressure cylinder, 64 in. diameter, and one low-pressure, 120 in. diameter, with a stroke of 4 ft. Steam of 65 lb. pressure is supplied by eight large oval and double-ended boilers, having 32 furnaces in all. Four boilers are placed forward of the engines, and the other four aft; but each pair of boilers is contained in a separate water-tight compartment. The chimneys, which are ample in size and height, are built of one-inch plate from the main deck to the flying deck above the turrets, so as to enable them to withstand the great shock produced by the discharge of the guns.

A very perfect system of fans and ventilating pipes has been carried out, so that the whole of the cabins, and even the engine-room are kept perfectly sweet and fresh. There is also another arrangement for ventilation very closely resembling in principle the furnace system of ventilation in a mine.

On the 25th of May the *Dandolo* proceeded to sea for her first official trial, under the command of Commandante E. Acton, who was accompanied by Admirals Martin-Franklin and Caimi. The run to Genoa and back was accomplished, without stopping, in six hours and twenty-eight minutes, with a mean indicated horse-power of nearly 7,200, and a *maximum* of 7,415 horses, and the speed obtained was 15½ knots, with a consumption of 51¼ tons of The main object of the run was to ascertain the consumption of fuel on a prolonged full-power run. On the 29th of May, the vessel was taken on the measured knot trial, when a speed of 15·55 knots was obtained with 8,050-horse power; the circle-turning proved that the vessel answers her helm admirably, and the circles were remarkable for their small diameter. On the 6th of June the final trial took place; the vessel attained on the measured knot at full power practically the same speed as before, with 8,150 indicated horse as the mean power, and a *maximum* of 8,250-horse. A trial was then made for a considerable time with half boilers, steam being easily maintained to give 4,420-horse power, with an average speed rather more than 11¾ knots. No steam blast was used on any of the trials. The engines worked with perfect regularity throughout, giving a *maximum* number of revolutions of 74 per minute, the pitch of the screw being 23 ft. 6 in. At the end of the day the condensers were worked with the common jet injection for nearly two hours. The vessel then returned to port. She is commissioned by Commandante E. Acton.

MACFARLANE'S PITCHOMETER.

FEW instruments are more valuable to the sea-going engineer, who desires to be thoroughly equipped for all emergencies, than a pitchometer. Such should be an instrument which, while compact in arrangement and by its simplicity not readily deranged, shall be at once mathematically correct in design and practically true in construction. These requirements seem well met by the invention of Mr. MacFarlane, introduced by Messrs. William Reid & Co. No steamship of any pretensions can afford to be without an apparatus which thus renders the engineer in dry dock independent of extraneous aid. In these modern days, too, of scientific invention and observation, the theory of the propeller ought to be studied by every engineer practically in the performance of every ship in which he sails, and for this it is absolutely necessary to be able at any time and place to accurately register the correct pitch of the blades.



Our engraving shows very clearly the construction and manner of applying the Pitchometer. A and F are two straight edges, jointed like a pair of compasses; C, a spirit level; E, the index plate, marking the pitch from 12 to 28 feet. To take the pitch, the instrument must first be closed up in the direction of the arrow, the straight edge, A, applied to the aft part of the propeller boss, B; the spirit level, C, set horizontal, and screwed up tight. The straight edge, F, marking diameters from 7 to 22 feet, is now placed on the propeller blade, shown in section at D, then when it is vertical, as indicated by the spirit level, the pitch can be read off from E. The problem is thus solved in an extremely simple manner. The accuracy of this instrument has been practically tested by many sea-going engineers, and as a recommendation of importance—other things being equal—we may add that the price is very moderate.

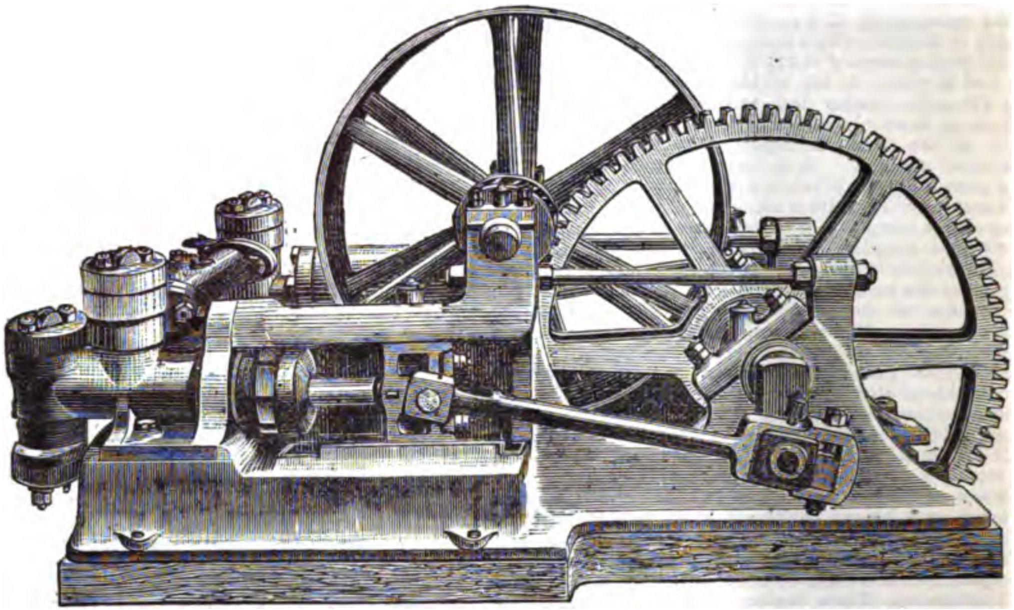
HYDRAULIC MACHINE TOOLS.

WE have deferred noticing one of the most interesting and suggestive displays at the Naval and Submarine Exhibition until we could illustrate some of the chief objects of interest shown by Messrs. Fielding & Platt, of Gloucester, in their very complete installation of hydraulic machine tools on Mr. Tweddell's system.

This system has already been referred to in these pages, but not the least proof of the soundness of the system is its progressiveness, since every succeeding year, and we might almost say month, finds some new development of the application of hydraulic power with which Mr. Tweddell's name is identified.

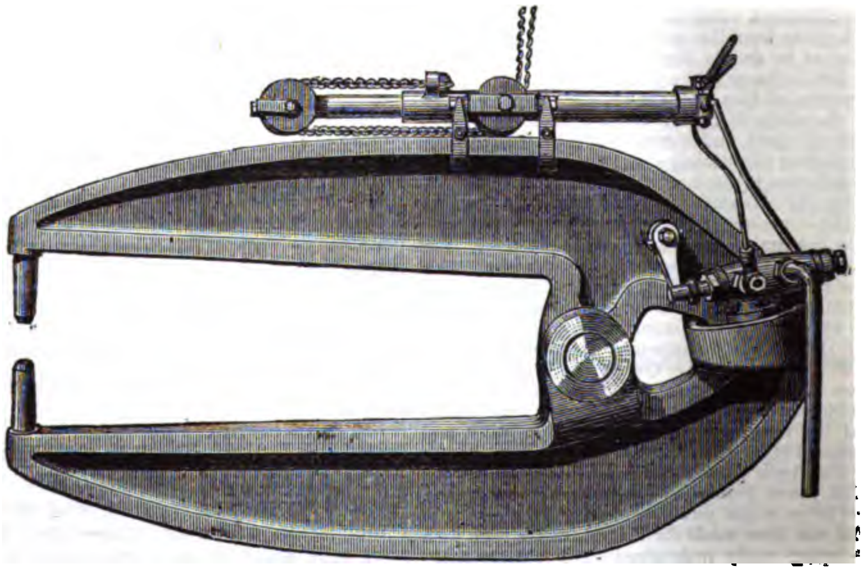
As the number of purposes for which these hydraulic machine tools are available increase, so has it been found necessary to put down more powerful pumping power and larger accumulator capacity. At the present time Mr. Tweddell is putting down extra power of this description in many works, which were fitted up by him some 14 or 15 years ago with pumps and accumulator only equal to working one rivetter. Our first illustration, Fig. 1, shows a pair of horizontal geared pumps, having 3 in. plungers and 12 in. stroke, and capable of forcing from 30 to 40 gallons of water per minute against a pressure of 100 atmospheres per square inch. In several cases these pumps are driven by steam cylinders, connected direct to the plungers, on what may be termed a twin Corliss type of bed plate.

FIG. 1.



HORIZONTAL GUARD PUMPS

FIG. 2.

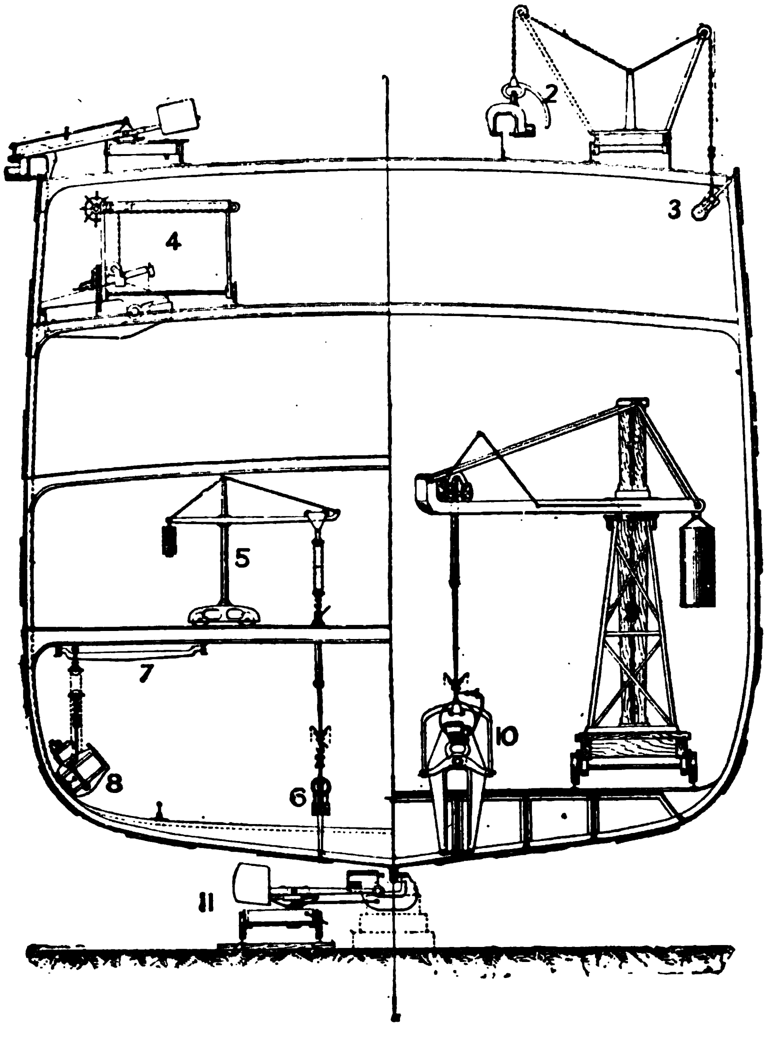


PATENT PORTABLE RIVETTER FITTED WITH HYDRAULIC CHAIN LIFT.

Our second illustration, Fig. 2, shows a large portable rivetter, the subject of a joint patent recently taken out by Mr. Tweddell & Messrs. Fielding and Platt. This mamachine has a gap of 4 ft. 6 in., and can close 1 in. steel rivets in stringer or intercostal plates in ship work; a speed of from 600 to 900 rivets per day this class of work can be maintained.

The form of hydraulic lift attached to the machine, as illustrated, allows a considerable vertical lift to be obtained with very little head room. The lifting power is applied through a chain working over pulley blocks, but so arranged that the stroke of the hydraulic rams is much shorter than the travel of the object attached to the outer end of the chain.

FIG 3.



SECTION OF A SHIP BEING RIVETTED.

The lift illustrated has a vertical range of 4-feet, while it only occupies the room taken up by the cylinder, say, 7 or 8 inches.

Our next illustration, Fig. 3, is a diagram showing the different actual applications up to the present of Mr. Tweddell's system to ship rivetting. For convenience of reference, the various applications are numbered:—(1) Is a portable rivetter attached to balanced levers on a light carriage; as this is run along the deck the machine closes the rivets, connecting the shear strake plates with the angles on water ways, &c. (2) Is a similar but lighter machine, suspended from a light crane and applied to rivetting the beading on hatchways; and (3) represents the same crane, employed at another time in carrying a portable rivetting machine to rivet the hold beams to frames, &c. (4) represents a larger rivetter, having a gap of from 3 feet 6 inches to 4 feet 6 inches carried on a light travelling carriage which is made up of parts all easily carried to the spot for putting together; the hydraulic lift, it will be seen, is attached to the machine, and by using multiplying chains, much head-room is saved. Machines thus arranged have put in from 500 to 600 rivets per day. (5) Shows a mode of utilising the hold beams when in *situ* for carrying a light jib crane, the jib having an all-round travel, can when carrying a machine as in (6) rivet up the floors when in place, and also reach all keelsons, &c., within its radius. (7) Is a light runner supported on the hold beams and carrying (8) a double-ended portable rivetter for keelsons. (9) Shows the arrangement used when the hold beams are not already in place; a travelling crane is erected on the top of the floors and rivets them up as fast as the beams and frames can be erected behind it, it is shown carrying a portable rivetter (10) having 4 feet 6 inch gap. The weight of this machine is of no consequence, since it is raised and lowered by hydraulic power; the lift, serving also as a pressure pipe, leaves all clear and free about the work—this machine can put in 600 to 900 rivets per day. (11) Represents a keel rivetter, this machine works at the same time as chipping and caulking is being done, so that having to remove the keel blocks is no objection; this machine has put in 450 rivets per day.

There were many other interesting models exhibited, among others a working model of the flanging machine, described in our October number last year, a machine which we see is being widely adopted, especially in our North-East ports where the boiler making is, as a rule, of a very high order.

From a paragraph in a Glasgow paper we perceive that the rivetters in one yard had demanded 30s. per 100 and obtained 25s. per 100 in place of 13s. for some of the work, which our last illustration shows, as being done by Tweddell's portable hydraulic rivetting machinery. Had the yard in question been fitted with such machinery as we have been describing, they would in all probability have been able to go considerably below 13s., instead of having to submit to such an increase.

SMITH'S PATENT SOUND SIGNAL WHISTLES.

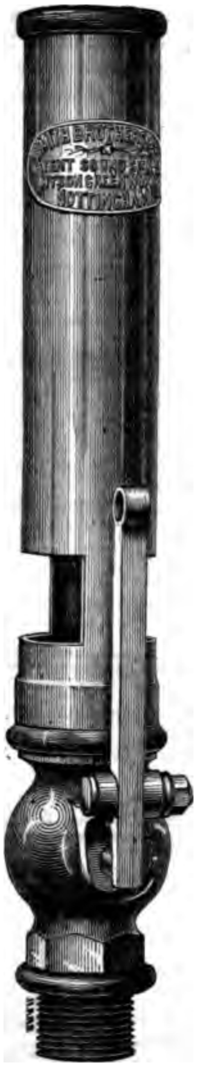
THE frequent collisions and resultant loss of life at sea that unfortunately happens so repeatedly, such as the loss of H.M.S. *Vanguard*, *Princess Alice*, and others, could without doubt have been averted if only some efficient method had been adopted of communicating from one vessel to another the course she was steering or proposed making.

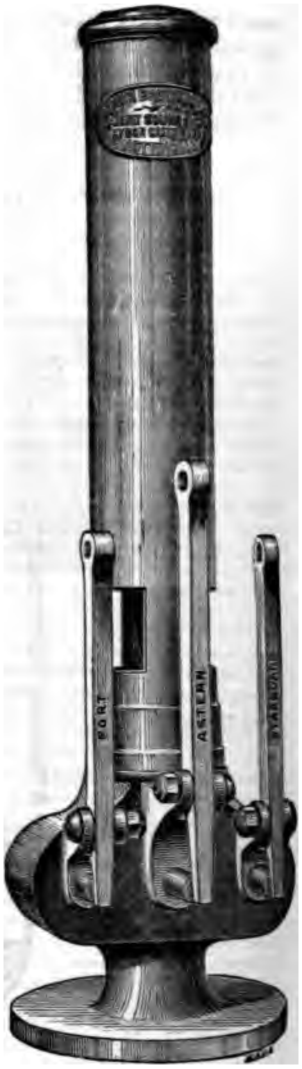
Up to the present no reliable method has been adopted.

According to "the rule of the road by sea," if a steamer alters her course—say to starboard—in order to get out of the way of another ship, she can communicate such alteration of course by giving one short blast on her whistle—if, however, she alters her course to port—this can be communicated by two short blasts; but if, on the other hand, it may be necessary to go astern, three short blasts will signify it. That is to say, the whistle can be used as a signal to indicate which way the vessel is running.

It is evident, however, that mistakes could easily arise in this system, as the first one or two blasts in the second and third signals might escape observation, and so give an entirely wrong impression.

To obviate this chance of error, Messrs. Smith, B & Co., of Hyson Green Brass Works, Notting have lately introduced their new type of sound [illegible] whistle, the distinctive and characteristic feature bein that it gives a separate and distinct sound for each signal, viz.: for starboard, a high pitch note; for port, a low bass note; and for astern, the two combined together.





The pitches of the two notes can be so adjusted, that when sounding simultaneously, a low and harmonious resultant tone is obtained, or a discordant one for fog signalling.

As these signals are quite distinct from each other, it is obvious each one can be made continuous, and so greatly enhance the chances of its being heard.

The construction of the whistle is as follows:—On a flanged base, forming a treble valve cock, and which is connected to a steam pipe, are three handles, marked

Port, Astern, and Starboard; the first and last open a communication from the steam orifice to each of the whistles, while the centre one admits steam to both simultaneously.

The upper part which forms the whistle proper is a round tube, closed at the upper end, and divided by a metal diaphragm, which acts as a sounding board and concentrates the sound; the depth of each side is adjusted by moveable stops so as to give the required tone, which is very easily done by remembering that the depth of a closed tube is one quarter the length of the wave length it gives rise to.

ON CORROSION IN STEAM BOILERS.

By W. J. Norris.

THE question of corrosion in steam boilers is one that commands the attention of most engineers. It is a standing source of anxiety, causes trouble and delay, and not unfrequently danger to those in charge. To the Navy, steamship owners, and steam users, it means great expense, not only in the actual cost of repairs, but in loss of efficiency, by having in a short time to reduce the pressure to compensate for the corrosion.

The rapidity of the internal corrosion of boilers working at high pressure, and supplied with water from surface condensers, assuming, as it does, the acute form known as "pitting," has enveloped it with a certain amount of mystery; and the short lives of the boilers of some of the vessels of H.M. Navy, led to the appointment of the late Admiralty Boiler Commission to inquire into the subject, before whom much evidence of value was given, and several theories advanced to account for this corrosion.

Of these theories the following have received the greatest credence, and which we may perhaps briefly consider:

Galvanic Action.—This theory has its origin in the hypothesis that a great, or rather infinite, number of galvanic circles are formed by the metallic contact of the iron of the boiler with particles of copper or brass from the condenser tubes, air pumps, and feed pipes, carried in with the feed-water, as the two elements, and the water acidulated or alkaline as the exciting agent. This theory will not, however, bear strict investigation, inasmuch as the particles of copper or brass would, by their weight, gravitate to the bottom of the boiler, where the greatest part of the corrosion would ensue; again, although the particles might possibly lodge and rest on the tops of the furnaces and tubes, they could not support themselves on the underside of same, where pitting is found to go on as much in the case of tubes and more in furnaces than on the top.

These considerations are sufficient in themselves to negative, or at least throw doubt on the truth of this theory, without taking into consideration the equivalent wear that must ensue in the air pumps, feed-pipes, and condenser tubes; nor can this theory be readily applied to the corrosion that takes place in steam chests and superheaters; and the reliable analyses hereto appended for reference, and which are copied from the Blue Book of the Boiler Commission, show the presence of nothing likely to account for galvanic action. Had particles of copper or brass been deposited within the boilers, they would have appeared in one or other of these analyses.

In fact, these analyses are somewhat remarkable, as showing the presence of nothing that could account for the corrosion and the rapidity with which it is effected, and we may dispose of the theory of galvanic action as untenable, by referring to the case of the *Propontis*, mentioned by Mr. A. C. Kirk in his evidence, who states that the vessel was fitted with Rowan's water tube boilers, ordinary working pressure at sea 120 lb., had no copper within the boiler, had iron feed pipes, and iron air pumps, the steam pipes being of copper, and the condenser tubes brass; but pitting went on with such rapidity that in about nine months a great part of the tubes had to be renewed. From this it is evident that there being no brass in the air pump, or copper pipes to be scored, particles of that metal could hardly have been carried into the boilers.

The next theory that has been advanced to account for the corrosion is that hydrochloric acid is produced within the boiler by decomposition of the water, its hydrogen combining with the chlorides contained in sea water. If such was the case the water would become strongly acidulated, and if it attained sufficient strength to cause pitting it would have a solvent action on zinc placed therein. Such is not, however, the result of practice, as it will be seen by the analyses above referred to, that the water has generally, and probably always, except in an isolated case or two, an alkaline reaction. Further, iron when heated with pure water, exerts no decomposing action, at least to 400 deg. Fahr., and it has, moreover, been established by careful experiment, that iron when heated with water alone to 356 deg. Fahr., yielded no trace of hydrogen. (*Vide* Admiralty Blue Book, Appendix A., p. 720, proving same.)

Another theory that has been received with favour is that of decomposition of the lubricants used for the cylinders and slides. The resulting fatty acids dissolving the brass of the condenser tubes, and passing into the boiler, convert the water into a solution of copper, which acts chemico-galvanically or electro-chemically upon the water and the iron, causing corrosion; but this theory is upset by the consideration that the wear of the condenser tubes would be in proportion to the corrosion of the boiler iron, and by the fact that pitting occurs just as much when the condenser tubes are tinned, and is further negatived by the usual alkaline condition of the water. In well-authenticated experiments it was found that water taken from marine boilers was not discoloured by the absorption of sulphuretted hydrogen gas, showing thereby that it held no copper in solution.

These two latter theories are further met, and may be considered as disposed of, by the remarks of Mr. Weston, Admiralty chemist, Porttmouth, in his evidence before the Boiler Commission on samples of water taken from the boilers of H.M. ships *Serapis* and *Crocodile*, which are well worth quoting, and are as follows:

Acidity.—Not one sample of water, either of those recently received or those obtained in December, showed any acidity, but, on the contrary, the water was in each case faintly alkaline, that from the hotwell being more strongly so than that from the boiler.

Copper in Solution.—A solution of copper I made for comparison, containing only one in one million parts, showed distinctly the presence of even this minute quantity of copper without resorting to any concentration of the solution, and as no indication was obtained from any sample of water from the troopships, this metal is certainly not present to any appreciable extent. The condenser tubes in the *Serapis* and *Crocodile* are mostly copper, only 400 out of 14,400 in the latter vessel having been replaced with tinned tubes.

And upon these results he makes the following observations:

1. That the alkaline condition of the water of these ships clearly shows that the acidity is not the cause of the deterioration of the boilers.

2. That the absence of copper in even the minute proportion to which I have tested the water shows that no injurious action from any solution of this metal by the water in passing through the condenser can take place, and as the copper is not dissolved to any extent, it would appear that tinning the tubes is unnecessary.

It will doubtless be admitted that these results and remarks are very conclusive, and although they apply to vessels of the Royal Navy, it is evident that they will be equally applicable to those of the mercantile marine.

Carefully and closely examining the above theories, one finds they are based on frail foundations, consequently neither is tenable, nor adequately explains the cause of corrosion in steam boilers, and we now come to the final theory of oxidation, by the presence of free oxygen in the water, derived from the atmosphere.

This latter theory appears to be the true one; the more closely it is examined, the more convincing does it, in the writer's opinion, become, and, moreover, it affords an answer to all the results observed in practice.

To show that this is the case we may now examine this theory, and adduce some proof thereof, but, in order to follow the line of reasoning upon which this conclusion is based, it is necessary to glance at, so as to have well in mind, the nature of the elements we have to deal with, namely, air and water.

Air.—Atmospheric air consists of a mixture of oxygen and nitrogen gases, in the proportion in one hundred volumes of

Oxygen	20.96
Nitrogen	79.04
	100.00

These gases, as composing air are simply mechanically mixed together, and not in any way combined, but each is in its free and natural state, retaining all its properties unaltered, and exercising separately and independently its own peculiar functions. Air also holds ammonia and carbonic acid; the former is perhaps of but little moment to the subject under consideration; the latter, however, plays an important part, and although it appears to exist in the atmosphere in no definite proportion, averaging only about one in 2,500 parts, it is comparatively very soluble in water.

Water.—Water in its pure state is a compound of oxygen and hydrogen, formed by the union of one volume of oxygen with two volumes of hydrogen, the two gases being chemically combined, and forming an entirely new substance, a neutral liquid, not retaining any of the distinctive properties of either gas from which it is produced, or able to exercise the functions peculiar to either gas without decomposition. It is incapable of combining with the metals, although it does so with some of their oxides and salts. By some metals it is rapidly decomposed, while it oxidises others by the aid of atmospheric air, even at the natural temperature. It is a very powerful solvent, liquefying alike both solids and gases, but has no effect on iron except when holding free oxygen in solution, when it becomes a powerful oxidising agent, and, as a general rule, the more oxygen it holds in solution the more rapidly does it rust or corrode iron, such corrosion being accelerated by increase of temperature, as well as by the presence of dissolved carbonic acid.

Such, then, are the constituent parts and properties of the elements with which we have to deal, and it is in the power of water to corrode iron by the aid of oxygen derived from the atmosphere, and accelerated by high temperature, to which the rapid deterioration of boilers must be ascribed.

Water absorbs and holds in solution all the gases, in volumes varying with its affinity, or the force of its attraction for each particular gas, and for the gases with which we are concerned, it dissolves in one hundred volumes, at 0 deg. Cent. temperature, and one atmosphere of pressure of

	Spec. Gravity.	Volumes.
Air ...	1.00	2.471
Oxygen	1.11	4.115
Nitrogen	.927	2.035
Carbon dioxide or carbonic acid	1.527	179.67

The law under which the absorption of gases by water takes place is as follows:

That the volume of gas absorbed varies directly with the pressure, the temperature remaining the same, that is to say, the volume absorbed is constant under all pressures at even temperatures. Therefore in order to find the volume of gas equivalent to its normal or natural tension, *i.e.*, one atmosphere of pressure, absorbed at any given pressure, provided no increase of temperature takes place, we have only to multiply the "co-efficient of absorption" by the number of atmospheres of pressure at which the absorption takes place.

The "coefficients of absorption" for the gases we have to deal with are as follows:

Atmospheric air	$C = .02471$
Oxygen	$C = .04115$
Nitrogen	$C = .02035$
Carbonic acid	$C = 1.7967$

These coefficients, however, are for 0° C of temperature, and the degree of solubility of these gases varies with any increase of temperature, becoming less as the temperature rises, and *vice versâ*, but the "coefficient of absorption" for any given temperature, within a moderate range may be found by a simple formula, viz.:

$$C_t = C - (x\,t + y\,t^2)$$

where

C = Coefficient of absorption at 0° C.

C_t = " " given temperature.

$\left.\begin{array}{l} x = \\ y = \end{array}\right\}$ Coefficients derived from experimental data.

t = Temperature.

For the gases we have under consideration these "coefficients" are as follows:

Atmospheric air	$x = .00065435$	$y = .000013547$
Oxygen ...	$x = .00108986$	$y = .000022563$
Nitrogen ...	$x = .00053887$	$y = .000011156$
Carbonic acid	$x = .07761$	$y = .0016424$

These "coefficients," as above, have been deduced from careful experiments by various chemists, verified by Bunsen, and will be found in Watt's "Dictionary of Chemistry," from which they have been extracted.

Therefore the volume of gas absorbed at any given pressure and temperature, having a tension of one atmosphere, is equal to

$$C - (x\,t + y\,t^2) \times P.$$

Where

P = Pressure in atmospheres.

t = Temperature.

C = Coefficient of absorption.

x and y Coefficients as above.

By the aid of this formula the following Tables of the absorption of gases under pressures and temperatures corresponding with the ordinary working pressures of steam boilers have been compiled.

(*To be continued.*)

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* MARINE ENGINEERING *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Moel-y-don.—On Saturday, June 17th, Messrs. William Doxford & Sons, of Sunderland, launched the iron sailing barque, *Moel-y-don* to the order of W. E. Jones, Esq., of Port Dinorwic. The *Moel y-don* is of the following dimensions, viz.:—Length between perpendiculars, 219 ft.; breadth, 35 ft.; depth 21 ft. She is classed 100 A at Lloyds, with a registered tonnage of 1,080 tons. This is the thirteenth vessel the same builders have built off this model.

La Capital.—On April 22nd Messrs. Edwards & Symes lannched from their shipbuilding and engineering works, Cubitt Town, London, E., the light draught turn screw steamer, named *La Capital*, for the Government of the Argentine Republic. The steamer's dimensions are 90 ft. long and 15 ft. beam, with raised quarter deck and forecastle, and is fitted with patent windlass and all the latest improvement.

On May 20th, Messrs. Edwards & Symes launched from their shipbuilding and engineering works, Cubitt Town, London, E. A light draught iron twin screw steamer for the Government of the Argentine Republic. The steamer's dimensions are 65 ft. long, 12 ft. beam with raised quarter-deck and forecastle, and fitted with patent windlass, and all the latest improvements.

On May 27th, Messrs. Edwards & Symes launched an iron screw ferry launch 40 ft. long and 7 ft. beam, and is fitted up with suitable accommodation as a ferry. They have also in hand two sister steamers, 65 ft. long and 12 ft. beam, for the Government of the Argentine Republic, three large cargo steamers, one screw steamer, five engine tug boats, and a light draught passenger paddle steamer, besides other smaller crafts.

Nessmore.—On May 20th there was launched from the Barrow Shipbuilding Company's yard a schooner-rigged steamer, of 3,4[illegible] tons, named the *Nessmore*. Her dimensions are as follows:—Length, 340 ft.; breadth, 40 ft.; and depth, 24 ft. 3 in. to main deck. She is fitted with Emerson Walker & Co.'s patent direct-acting steam windlass, and built to the order of Wm. Johnston & Co., of Liverpool, and has compound, inverted, direct-acting, surface condensing engines of 1,900 indicated horse-power, cylinders 42 by 80 by 48 stroke, 80 lbs. pressure of steam.

Roumania.—On May 20th there was launched from the shipbuilding yard of Messrs. William Pickersgill & Sons, Southwick, an iron screw steamer of the following dimensions:—Length, 235 ft.; breadth, 33 ft. 6 in.; depth of hold, 16 ft. 2 in. She has been specially designed for trading between the Danube, the Azof, and Black Sea ports, where a light draught of water is required. She has a raised quarter deck, long bridge amidships, and topgallant forecastle. All decks of iron; with double bottom throughout for water ballast; four hatchways, four horizontal steam winches and donkey boiler, longitudinal iron shifting boards, Harfield's patent windlass, anchor crane in forecastle, and Higginson's quartermasters steam steering gear. The machinery and boilers have been constructed by Mr. George Clark, of Southwick. The boilers are two in number, of steel, and of 80 lbs. pressure. The engines are on the inverted, direct-acting, compound surface-condensing principle, of 120-horse power nominal, with cylinders 27½ in. and 55 in., and 36 in. stroke. The hull, outfit, and machinery have been constructed under Lloyd's special survey to their highest class. The steamer has been built to the order of Captain Walter M. Donaldson & Partners, and the captain has superintended her during construction, and will take command on behalf of the Roumanian Steam Shipping Company, of Constantinople and Liverpool. The managers are Messrs. Thomas Russel & Son. As the vessel left the ways she was named the *Roumania* by Mrs. Donaldson.

Sardomene.—On May 27th Messrs. Oswald, Mordaunt & Co. launched from their shipbuilding and engineering works, Southampton, an iron sailing ship of 2,000 tons register, named the *Sardomene*, built to the order of Messrs. H. Fernie & Sons, Liverpool, of the following dimensions:—Length, 270 ft.; breadth, 39 ft. 6 in.; depth of hold, 24 ft. The ship is built with full poop, monkey forecastle, and large midship house for crew. She is fitted with Harfield's patent windlass for lifting anchors, and all the latest improvements. She is intended to class 100 A 1 at Lloyd's, and 20 years in the Liverpool Underwriters' Registry. The ceremony of naming the vessel was performed by Miss Louisa Pitt, of Danham. During the course of construction the vessel has been inspected by Mr. Malcolm, and when fitted out will be commanded by Captain Pitt.

Ville de Para.—On June 1st Messrs. Schlesinger, Davis & Co., launched from their building-yord at Wallsend, an iron spar-decked steamship named the *Ville de Para*, built for La Societé Postale Française de l'Atlantique, of Havre and Paris. Her dimensions are as follows:—285 ft. between perpendiculars, 37 ft. broad, and 26.7 depth of hold, classes 100 A1 at Lloyd's, and has been built under the special inspection of Lloyd's and the owners' surveyors. Being principally intended to carry passengers and mails, she is fitted up with a saloon and berths aft for 40 first-class passengers, and with removable iron fittings for 280 emigrants in the forward 'tween decks. The engines are being constructed by Messrs. Hawthorn, Newcastle, and are of 265 nominal horse power. Many parts of these engines are made of steel for the sake of gaining strength without increasing weight; the boilers are also of steel.

Carn Brea.—On June 1st there was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), of Willington Quay-on-Tyne, an iron screw steamer of the following dimensions, viz:—Length between perpendiculars, 265 ft.; breadth extreme, 36 ft.; and depth, 19 ft. She will be fitted with engines by the North-Eastern Marine Engineering Company (Limited), of Sunderland, cylinders 33 in. and 63 in.—39 in. stroke, and will be classed 100 A 1. The vessel has been built to the order of Edmund Handcock, Esq., of Falmouth, and was named the *Carn Brea*, on leaving the ways, by Mrs. Butterworth, of North Shields.

Hypatia.—On June 2nd Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer built to the order of Mr. T. Herskind, of West Hartlepool. Her dimensions are:—Length B.P., 285 ft.; beam, extreme, 36 ft.; depth, moulded, 25 ft. 2 in.; and she is expected to carry 3,050 tons deadweight. She has topgallant forecastle, long bridgehouse, double bottom for water ballast, constructed on the cellular principle, main deck of iron and upper deck of wood. She will be fitted for four steam winches, donkey boiler, patent windlass, and the rig will be that of a double topsail schooner, with iron lower-masts. This steamer has been built under Lloyd's special survey for the 100 A 1 class to the three deck rule, and under the inspection of Mr. Fothergill, the Owner's superintendent engineer. Engines of 200-horse power will be fitted by Messrs. T. Richardson & Sons, of Hartlepool. The checking of the way upon the vessel after entering the water was in this case effected by flexible steel wire ropes instead of the usual chain cables. This is worthy of notice as a novelty in launching, and was quite successful, showing itself in several ways an improvement upon the old method. On leaving the ways the steamer was christened *Hypatia* by Mrs. J. J. Woods, of West Hartlepool.

Nonpareille.—On June 3rd the yawl *Nonpareille*, 72 tons, Major Hanmer, was launched from the yard of Messrs. Camper & Nicholson, at Portsmouth, and was christened by Miss Ethel Lapthorn. The *Nonpareille* is built as a cruiser, and has the highest class, A 1 18 years, at Lloyd's.

Flying Fish.—On June 3rd there was launched a large steam tug from the yard of Messrs. Eltringham & Co., South Shields, called the *Flying Fish*. Her dimensions are:—Length, 116 ft.; breadth, 19 ft.; and depth, 10 ft. The tug was built was to the order of Mr. Siddall, of Sunderland.

B. Granger.—On June 3rd Messrs. Turnbull & Son launched from their shipbuilding yard, Whitby, an iron screw steamer of the following dimensions:—Length, 240 ft.; breadth, 34 ft.; depth, 17 ft. 9 in.; with a dead-weight carrying capacity of about 1,950 tons; engines by Blair & Co., of 130 horse power. The vessel is built to the order of Messrs. Robinson & Rowland, of Whitby, and is intended for the Mediterranean and general trades. She was christened the *B. Granger* by Mrs. B. T. Robinson, wife of the principal Owner.

Brooklands.—On June 3rd, Messrs Wm. Gray & Co. launched from their South Yard, at Hartlepool, an iron screw steamer of the following dimensions:—Length, 245 ft.; breadth, 31 ft. 6 in. depth, 15 ft.; built to the order of Messrs. Hardy, Wilson & Co. of West Hartlepool, intended for general trade to carry 1,450 tons. She is fitted with double bottom for water ballast, long raised quarter deck, and topgallant forecastle for Crew. The engines, which are being supplied by Messrs. Blair & Co., Stockton, are 110-horse power. On leaving the ways the Christening ceremony was performed by Miss Lillie Trewhitt, of West Hartlepool, the vessel being named *Brooklands*.

Shamrock.—On June 3rd, a new saloon boat was launched from the works at Battersea of the London Steamboat Company, and she will be placed on the service of the Company in about three weeks. The vessel was named the *Shamrock*, and the ceremony of christening was performed by Miss Maud Pelly, the youngest daughter of Captain Pelly, R.N., chairman of the Company. A peculiarity of the boat as compared with the rest of the Company's fleet is, that she will be able to carry the up or down traffic, travelling either to Teddington or to Gravesend.

Wilberforce.—On June 3rd, Messrs. John Readhead & Co., launched a screw steamer for Messrs. Robert Harrowing & Co., of Whitby, at South Shields. The vessel's measurements are:—Length, 249 ft.; breadth, 36 ft.; depth, 17½ ft.; her deadweight carrying capacity being 1,750 tons. Her engines will be of 120-h.p. nominal. The vessel was named the *Wilberforce*.

On June 3rd. Messrs. C. S. Swan & Hunter, Wallsend, Newcastle-on-Tyne, launched an iron screw steamer, 250 ft. by 35 ft. by 18 ft.; built to the order of R. B. Avery, Esq., Queen-street, Newcastle. The steamer is intended for the Mediterranean and Baltic Trades, and will be fitted with engines 32 and 62 inches diameter, and 36 in. stroke, by the Wallsend Slipway and Engineering Company (Limited).

Storra Lee.—On June 3rd, Messrs. Wm. Gray & Co. launched from their North Yard, at West Hartlepool, a steamer of the following dimensions:—265 ft. by 35 ft. 6 in. by 19 ft. She is built to the order of Messrs. J. H. Murrell & Co., of West Hartlepool, and is intended for India and general trade, and intended to carry about 2,400 tons. She is fitted with double bottom for water ballast, and all the recent improvements in steam winches, &c. The engines, which are 150-horse power, are being supplied by Messrs. Blair & Co., Stockton. On leaving the ways the christening ceremony was performed by Mrs. F. G. Morris, of Hartlepool, the vessel being named *Storra Lee*.

James Williamson.—On June 5th, Messrs. Nicholson & Marsh launched from their shipyard at Glasson Dock, near Lancaster, a three-masted schooner for the coasting trade, built to the order of Messrs. John Bradshaw & Co., Fleetwood. Her dimensions are as follows:—Length, 95 ft.; breadth, 22 ft. 7 in.; depth of hold, 10 ft. 2 in.; and 128 tons register. Will carry about 230 tons, and sail without ballast. She was launched with all her masts and yards aloft. The Mayoress of Lancaster performed the christening ceremony, the vessel being named *James Williamson*, after the giver of Williamson Park, Lancaster, and she will hail from the port of Lancaster.

Chigwell.—On June 15th, Messrs. Robert Thompson & Sons launched from their shipbuilding yard, Southwick, Sunderland, an iron screw steamer of the following dimensions, viz:—Length 249 ft.; breadth, 35 ft.; depth 15 ft.; built for Alfred Suart, Esq., London, under Lloyd's special survey for the highest class. The vessel has been constructed to carry a large cargo on very small draught, and has long full poop extending over engine and boiler space, with large cabin aft for Captain, and accommodation under bridge for Engineers and Officers, and topgallant forecastle fitted up for Crew and Firemen. She is schooner-rig, and has large hatchways to serve as grain feeders, and ample water ballast, also large donkey boiler and three steam winches by Messrs. Roger & Co., Stockton, and Harfield & Co.'s patent windlass, &c. Her engines, which are of 120 nominal horse power, will be fitted by John Dickinson, Esq., Sunderland. As the steamer left the ways she was named the *Chigwell* by Mrs. Press, wife of the Captain.

Countess Evelyne.—On June 17th, Messrs. S. Caird & Purdie, iron shipbuilders, Barrow-in-Furness, launched from their yard a screw steamer built to the order of Mr. Ware, of Cardiff. The new vessel received the name of the *Countess Evelyne* from the hands of Mrs. Caird, and is of the following dimensions:—Length, 245 ft.; beam, 34 ft.; depth of hold, 17 ft. Her engines will be supplied by Messrs. Westray, Copeland & Co., of Barrow. The *Countess Evelyne* is intended for the general cargo trade. The gross tonnage is about 1,500 tons.

Dynomene.—On June 17th, Messrs. W. H. Potter & Son launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, an iron sailing ship of the following dimensions:—Length, 270 ft.; breadth, 39 ft. 9 in.; depth 24 ft. 3 in.; tonnage ett register, 1,900 tons; deadweight capacity, 3,100 tons, This vessel is fitted with all the most recent improvements, and and takes the highest class in both Lloyd's and the Liverpool underwriters' books, her scantlings being considerably in excess of their requirements. As she left the ways she was christened the *Dynomene* by Miss Edith Kerr Wilson, daughter of Mr. Henry Wilson. The vessel has been built to the order of Messrs. Henry Fernie & Sons, of Liverpool, and is the eighth large ship built for them by Messrs. Potter. She will be commanded by Captain Randall, and will sail next month for Calcutta.

Kovno.—On June 5th, there was launched from Messrs. Earle's shipbuilding yard this schooner-rigged steel screw-steamer, of about 1,700 tons gross tonnage. Her dimensions are as follows: —Length, 270 ft.; breadth, 34 ft.; depth in hold, 18·3 ft. She is built to the order of Messrs. Thomas Wilson, Sons & Co., of Hull, for which firm three other vessels, of the same type, are being built at the same yard. The *Kovno* is intended for the Baltic and Mediterranean service. Her dead-weight carrying capacity is 2350. She has engines of 140 nominal horse-power.

Justitia.—On June 6th there was launched from the Barrow Shipbuilding Co.'s yard an iron schooner-rigged steamer, of 3,036 gross and 1,981 nett tons, named the *Justitia*. Her dimensions are as follows:—Length, 340 ft., 5 in.; breadth, 37 ft. 7 in.; and depth, 29 ft. 5 in. She was built to the order of the Barrow Steamship Co., London, and has compound inverted direct acting surface condensing engines, of 480 nominal h.p., cylinders 33 by 66 by 60 stroke.

Albertina.—On June 7th Messrs. D. Baxter & Co. launched a steamer from their yard, at the North Sand Point. Monkwearmouth, to the order of Messrs. Fisher, Renwick & Co., Newcastle. Her dimensions are:—Length, 185 ft.; breadth, 30 ft.; depth of hold, 13 ft., and she has been built under special survey (Mr. A. Taylor representing the owners) to class 100 A 1 at Lloyd's. She has a long raised quarter deck and topgallant forecastle, and will be fitted with Emerson Walker's Patent Windlass, Taylor's three-cylinder engines by Messrs. Douglas & Grant, of Kirkcaldy, the boilers having a working pressure of 150 lbs. to the square inch. The steamer will carry 900 tons of cargo on a light draught of water, and is intended for the general trade. Miss K. Renwick (sister of one of the owners) christened her the *Albertina*. Unfortunately the checking chain, owing to a flaw in one of the links, snapped when the steamer was in mid-stream, the consequence being that she ran right over the river, coming in contact with the quay, and receiving slight damage to the stern.

The Mary Beatrice.—Shortly after 1 o'clock on June 15th, there was successfully launched from the yard of Messrs. Samuda Brothers, at Poplar, a new passenger steamship for the South-Eastern Railway Company. This addition to the company's fleet, which is intended for the Folkestone and Boulogne service, is 255 ft. long, with a breadth of 29 ft., and a depth of 15 ft. 6 in. She is 1,063 tons burthen of O.M., and is expected to attain a speed of 18 knots per hour. She is a paddle steamer, and will be fitted with engines of 2,800 indicated horse power by Messrs. John Penn & Sons. The engines will be surface condensing, having a pair of oscillating cylinders, each 72 in. in diameter, with a 5 ft. stroke. They will be supplied with steam at 30 lb. boiler pressure. This vessel is in all respects similar to the latest additions to the South-Eastern Company's fleet, except that she is 5 ft. longer, and has surface condensers. To this latter circumstance the increase in her length is due, extra space having been required in the engine-room for the condensers. Upon the occasion of the launch, a large number of visitors were present, who had been conveyed from Westminster to Messrs. Samuda's works in a special steamer. Among the company were Lord and Lady Alfred Churchill, Lord Arthur Russell, M.P., Sir Edward and Lady Watkin, Mr. C. M. Norwood, M.P., and Mr. Myles Fenton. The vessel was named the *Mary Beatrice* by Mrs. Worsley Taylor, who, by cutting a cord, released the dog-shores, when the vessel glided down the launching ways into the water, After the launch, the visitors were entertained at luncheon, at which Mr. J. D'A. Samuda presided. After the usual loyal toasts, Mr. Samuda proposed the toast of "Success to the South-Eastern Railway Company," pointing out how they had gradually increased the size and speed of their boats. Sir Edward Watkin, in acknowledging the toast, said the company had endeavoured to do away with the national disgrace of bad boats for the Channel service. He referred to the improvements which were being made in the harbours at Calais and Broulogne as a step in the right direction, and observed that with improved harbour accommodation, a service of larger steamers might be put on. In fact, looking at these improvements, he hoped at no distant time the South-Eastern Company would preform the service between London and Paris in 7½ hours, and with comfort to the passengers. Sir Edward Watkin concluded by proposing the health of Mr. Samuda, who, in acknowledging the toast, referred to the improvements which were being made at Folkestone by carrying the pier out into deep water, and which, with the improvements on the other side of the Channel, would enable vessels of larger size and higher speed to be put on the station.

Ascalon.—On June 17th, there was launched from the yard of Messrs. Campbell, Macintosh, & Bowstead, Scotswood, on Tyne, a steamer, built for Messrs. W. Milburn & Co., of Newcastle. She was named the *Ascalon*. Her dimensions are:—Length, 200 ft.; breadth, 37 ft.; depth, 27 ft. 6 in. She has a deadweight capacity of 3,300 tons. Her engines will have 33-inch and 69-inch cylinders, with a piston stroke of 45 in., and will be of 270 nominal horse power. The vessel, which will be schooner rigged, will class A 1 at Lloyd's. Her windlass is by Emerson Walker & Co.'s patent horizontal direct steam.

Bombay.—On June 17th, there was launched from the yard of Messrs. C. Mitchell & Co., Low Walker, on the Tyne, an iron screw steamer named the *Bombay*, built to the order of Messrs. Nelson, Donkin & Co., of Newcastle. Her dimensions are:—Length, 345 ft.; breadth, 41 ft.; and depth of hold, 29 ft. Her carrying capacity is 4,500 tons.

Raffaele Rubattino.—On June 17th there was launched from the Jarrow yard of the Palmer Shipbuilding and Iron Company a mail steamer named the *Raffaele Rubattino*, and built to the order of Messrs. R. Rubattino & Co., of Genoa, the managers of the Rubattino Steam Navigation Company. She is a sister ship to the *China*, launched from the same yard in February last. Her dimensions are:—Length, 412 ft.; breadth, 44 ft.; and depth 31 ft. 3 in. She has been built to take the highest class at Lloyd's, and is even in excess of their requirements. She is built upon the spar-decked principle, with extra scantlings for iron main and spar deck. The spar deck is sheathed with teak, and the lower 'tween decks are laid with pine. She will have a bridge house 107 ft. in length over the engine and boiler space, in which will be situated the accommodation for the captain, officers, engineers, doctor, purser, &c.; whilst the crew and firemen will have quarters in a topgallant forecastle. The steamer will have water ballast to the extent of 450 tons in the after-hold, and under the boiler-room, will be brig-rigged, with iron lower masts and lower yards. The vessel will be supplied with Emerson & Walker's patent horizontal direct steam windlass, with warping capstan standing forward on same deck driven by shaft and bevil gearing, Muir & Caldwell's steam-steering gear on bridge amidships, and Hastie's screw clutch gear aft; copper fresh water condensers by Brownlee & Co., of Glasgow. She will be provided with eight boats, including one steam launch built of steel, three cutters, also of steel, and four of wood. The engines will be supplied by Palmer's Company. They will be of 500-h.p. nominal, the cylinders being respectively 54 and 96 inches, and the stroke of the piston 60 inches. She will have four cylindrical double-ended boilers, and also two donkey boilers. The deadweight carrying capacity is 4,500 tons. The steamer is intended for the mail service between Genoa and Bombay. She has been built under the personal superintendence of Captain Brizzolesi, of Genoa. The ceremony of christening the steamer was performed by Mrs. Armstrong, wife of Mr. Robert Armstrong shipyard manager.

General Elliott.—On June 19th there was launched from the yard of Messrs. Raylton Dixon & Co., Middlesbrough, an iron screw steamer, built to the order of Messrs. Smith, Imossi & Co., of Gibraltar, and to be principally employed in the coal trade of that port. Her dimensions are:—Length over all, 250 ft.; breadth, 34 ft.; depth of hold to floors, 17 ft.; and she will carry about 1,800 tons deadweight. She is built on the quarter-deck system, and has water ballast in both holds, bridge amidships, topgallant forecastle, iron decks, &c., with steam steering gear, winches, and all the latest improvements for this class of vessel. She will be fitted with engines of 130-horse power by Messrs. Blair & Co. (Limited). On leaving the ways she was christened the *General Elliott* by Miss Ada Dixon, daughter of her builder. This vessel is the second of two sister ships building by Messrs. Raylton Dixon & Co. for Messrs. Smith, Imossi & Co., of Gibraltar, the former of which, the *Admiral Rooke*, was launched about a month ago. It is, moreover, worthy of note that these will be the first two British ships owned in Gibraltar.

Nesta.—On June 14th there was launched from the building yard of Messrs. R. & J. Evans & Co., Brunswick Dock, a fine iron screw steamer of 2,300 tons burthen, built to the order of Messrs. Richards, Mills & Co., Liverpool, and Messrs. Richards, Tweedy & Co., London, and intended for the Spanish and and Mediterranean trades. The engines and boilers are supplied by Messrs. De Winton & Co., Union Ironworks, Carnarvon. The vessel was christened the *Nesta* by Mrs. Bardsley, wife of the Venerable Archdeacon Bardsley, and successfully launched by her sister, Miss Powell. Messrs. R. and J. Evans have in progress of construction two other similar steamers for the same firms.

Portugalete. — On June 20th a screw steamer named the *Portugalete*, and built to the order of Messrs. Morel Bros. & Co., of Cardiff, was launched from the Howdon yard of Palmer's Shipbuilding and Iron Company (Limited). The dimensions of the vessel are as follows:—Length, 260 ft.; breadth, 35 ft.; depth of hold, 19 ft. The steamer is fitted with patent windlass by Emerson, Walker & Co., London, and is intended for the Bilbao and general trades, will be fitted with a pair of Palmer's engines of 130-horse power nominal.

LAUNCHES.—Scotch.

Maracas.—On June 22nd Messrs. M'Millan & Son launched from their dockyard at Greenock, a double-bottomed iron sailing ship of 1,705 tons, B.M. The new ship was named *Maracas*, and has been built to the order of Messrs. William Kenneth & Co., of Glasgow. The double-bottom will contain 300 tons weight of water, and is divided into three compartments arranged to suit the trimming of the ship under almost all circumstances. Very powerful pumps are fitted to each compartment, capable of pumping out the whole 300 tons in about three hours. She is also fitted with Emerson, Walker & Co's patent capstan windlass, two powerful steam winches, donkey boiler and condenser, and has iron lighthouses fitted on each side of the forecastle, accessible from underneath, and thus avoiding much personal risk in heavy weather. The ceremony of naming the vessel was performed by Mrs. Kenneth, Lea Bank, Dumbartonshire.

Matterhorn.—On June 22nd Messrs. Russell & Co., Greenock, launched from their yard a four-masted iron sailing vessel of 1,850 tons. Dimensions:—Length, 257 ft.; breadth, 40 ft.; depth of hold, 23 ft. 9 in. The vessel is fitted with Emerson, Walker & Co's patent capstan windlass, and has been built to the order of Mr. De Wolff, of Liverpool, was named the *Matterhorn*. When completed she is to be loaded at Liverpool for San Francisco.

Navarra.—On May 24th Messrs. Henry Murray & Co. launched from their shipbuilding-yard at Port Glasgow an iron screw steamer, of about 900 tons deadweight capacity, and of the following dimensions:—Length, 194 ft.; breadth, 27 ft.; depth, 14 ft. The vessel upon leaving the ways was named *Navarra* by Mrs. Robert Taylor, of Partick. The *Navarra* has been built for Messrs. Henry Lamont & Co., Glasgow, and is intended for the Spanish and Mediterranean trades. She has been built to the highest class at Lloyd's, and is fitted with 170 tons water ballast in double bottom in fore and after holds, three steam winches, and all the latest improvements. Immediately after the launch the *Navarra* was towed to Dumbarton, and thence she will proceed to Glasgow to receive her engines of 110-horse power nominal, which are being supplied by Mr. Wm. Kemp, Helen-street Engine Works, Govan. During construction the vessel has been superintended by Messrs. M'Nicol & Smith.

Chung King.—On May 29th Messrs. Scott & Co. launched from their shipbuilding-yard at Cartsdyke, Greenock, an iron twin-screw steamer of about 1,700 tons register, and of the following dimensions:—Length, 243 ft.; breadth, 32 ft.; and depth (moulded), 21 ft. The vessel on leaving the ways was named the *Chung King*. The *Chung King* has been built for Messrs. John Swire & Sons, London, and is intended for the China trade. She has been built to the highest class at Lloyd's, and is fitted with all the latest improvements for loading and discharging cargo. Immediately after the launch she was towed by Messrs. Steel & M'Caskill's tug *Hotspur* to the Victoria Harbour to receive her engines, of 250-horse power nominal, which are supplied by the Greenock Foundry Company.

Wans Fell.—On May 30th, Messrs. H. McIntyre & Co. launched from their shipbuilding yard at Merksworth, Paisley, the *Wans Fell*, an iron screw steamer. This steamer is one of a number now building for the Fell Line, which is managed by Messrs. Hume Smith & Co., Liverpool, is classed 100 A 1 at Lloyd's, and has all the most recent improvements as a cargo boat. She is built to the designs and specification of Messrs. M'Kay and Stitt, Liverpool, and is to be fitted with compound surface-condensing engines by Messrs. Kincaid & Co., Greenock. The launching cord was cut and the steamer named by the Misses Kincaid, Corrie Bank, Greenock.

Firth of Clyde.—On May 31st Messrs. Dobie & Co. launched from the Govan Shipbuilding-yard an iron sailing ship, built to the order of Messrs. James Spencer & Co., Glasgow, for their "Firth" line. This vessel measures 1,250 tons gross, and is classed 100 A 1 at Lloyd's. As the vessel left the ways she was named the *Firth of Clyde* by Mrs. Wyllie. The *Firth of Clyde* proceeds at once to load for Sydney, under the command of Captain Smith.

Atlas.—On May 31st Messrs. Aitken & Mansel launched from their yard at Kelvinhaugh, a screw steamer of 2,500 tons gross register, for the Atlas Steamship Company of Liverpool and New York. This vessel, which received the name *Atlas* from Miss M. Blair, of Overnewton, has been fitted up for the company's mail and passenger service between New York and the West Indies, and is furnished with all the latest improvements. The engines, which are 400-horse power nominal, will be fitted by Messrs. John and James Thomson, Finnieston Foundry. The construction of this vessel has been under the supervision of W. C. Lang, Esq., of Liverpool.

Brittany.—On May 31st Messrs. John Elder & Co. launched from their shipbuilding yard, at Govan, a steamer built to the order of the London, Brighton, and South-Coast Railway and the Western of France Railway. She is named the *Brittany*. Her dimensions are as follows:—Length, 230 ft.; breadth, 27 ft. 6 in.; depth, 11 ft. 8 in. She is steel constructed, and of about 600 tons gross. Her cylinders are 46 in. and 83 in., and the stroke 60 in. The steamer is fitted up for 100 first and 70 second-class passengers. She has four steel boilers 100 lbs. pressure, 2,200 I.H.P., and her speed is about 17½ knots.

Pavonia.—On June 3rd, the steamship *Pavonia*, built for the Cunard Company (Limited) by Messrs. J. & G. Thomson, was launched from their yard, Clydebank. Mrs. Scarlett named the huge ship, which glided safely into the river. The *Pavonia* is the 32nd vessel built for the Cunard Company by Messrs. J. & G. Thomson. She is of 5,500 tons gross register, her dimensions being:—Length between perpendiculars, 430 ft., breadth, 46 ft., depth (moulded), 36½ ft. Her indicated horse-power will be 4,500 which is expected to drive her at 14 knots at sea. Though not so fast as the *Servia*, the last addition to the Cunard fleet launched by the same builders, she is fitted up in quite as handsome a style. She has accommodation for 176 first-class passengers and 1,000 emigrants. The dining saloon for the first-class passengers is 46 ft. square, and the smoking-room is 20ft. square. The crew are housed in a large topgallant forecastle, which also contains ice houses, vegetable lockers, lavatories for emigrants, &c. The officers' accommodation is all in the upper deck, but in spite of this the deck is, as in all the Cunard ships, quite clear for promenading. She is divided into 11 watertight compartments, which, together with the coal protection provided abreast of the machinery, will render her of great service to the Admiralty as a cruiser in time of war. She has been surveyed while building for Admiralty requirements. She will carry 8,300 tons of deadweight when fully laden.

Pembrokeshire.—On June 3rd the London and Glasgow Shipbuilding Company launched at Govan, for Messrs. Jenkins & Co., London, a screw steamer of about 2,800 tons gross register, her dimensions being as follows:—Length, 330 ft.; breadth, 38 ft. 6 in.; depth, 25 ft. 8 in., and built to Lloyd's highest class under special survey. The steamer, which will be fitted by her builders with compound surface-condensing engines of 500 nominal horse-power, steam steering gear, &c., will form one of Messrs. Jenkins & Co.'s well-known "Shire" Line of steamers trading between London and Japan. As the vessel left the ways she was named the *Pembrokeshire* by Mrs. Robertson, Pollokshields.

Clan Campbell.—On June 5th, the *Clan Campbell*, an iron screw steamer of about 2,600 tons, was launched at Linthouse, Govan, and named by Miss Mary Stuart, of Kelvinside. The *Clan Campbell* is the sixth steamer built by Messrs. Alexander Stephen & Sons for Messrs. Cayzer, Irving & Co.'s Clan Line, for which the same builders have two similar vessels in course of construction. She is fitted with provision for water ballast in double bottom on bracket principal throughout; is built under special survey to class 100 A 1 three-deck rule in Lloyd's, with scantlings considerably in excess of the requirements for the same; and has the extra number of water-tight bulkheads required by the Admiralty in order to being placed on their list of vessels suitable for transports. The passenger accommodation is very airy. spacious and elegant; and the comfort of officers and crew has also had careful attention. The appliances for working both ship and cargo are all of the most approved description. The main engines (which were fitted on board before launching) have cylinders 38 in. and 68 in. diameter by 45 in. stroke, with ample boilers suitable for working at 85 lbs. pressure.

Chandernago.—On June the 5th Mesrs. William Denny & Bros. launched from Leven Shipyard, Dumbarton, an iron screw steamer of about 3,060 tons gross measurement, for the Compagnie Nationale de Navigation, of Marseilles. On leaving the ways she was named the *Chandernago* by Mrs. Denny, of Helenslee. The dimensions of the vessel are—Length between perpendiculars, 340 ft.; breadth moulded, 40 ft.; depth moulded, 30 ft. She has been built in accordance with Rules of the Bureau Veritas for the highest class, and will have accomodation for 24 first-class and 24 second-class passengers. She will be fitted by Messrs. Denny & Co. with compound surface-condensing engines of about 2,000 indicated horse power, the cylinders being 72 ins. and 41 ins. diameter, and length of stroke 51 ins. While being constructed, the vessel was under the inspection of M. Rondett, the superintending engineer of the company.

Kovno.—On June 5th there was launched from Messrs. Earle's shipbuilding yard, a schooner-rigged steel screw steamer, of about 1,700 tons gross tonnage, named the *Kovno*. Her dimensions are as follows:—Length 270 ft.; breadth 34 ft.; depth in hold, 18·3 ft. She is built to the order of Messrs. Thomas Wilson, Sons & Co., of Hull, for which firm three other vessels, of the same type, are being built at the same yard. The *Kovno* is intended for the Baltic and Mediterranean service. Her deadweight carrying capacity is 2,350 tons. She has water ballast in double bottom, all fore and aft, a raised quarter deck, long bridge and topgallant forecastle. Is built to class 20 years Liverpool, and has engines of 140 N.H.P.

Loch Ness.—On June 5th Messrs. John Elder & Co., launched from their Fairfield yard, Govan, a cargo steamer, built to the order of Messrs. Ireland, Leitch, & Co., for the Dundee Loch Line of steamers, of which they are Managing Owners. As the vessel left the ways she was named the *Loch Ness* by Miss Brownlie, of Dundee. The principal dimensions of the vessel are as follows:—Length between perpendiculars, 225 ft.; breadth 31 ft. 6 ins.; depth moulded, 17 ft. 6 ins.; compound engines with 25 and 50 in. cylinders, by 3 ft. stroke, and working with steam of 100 lbs. pressure. The vessel is fitted with double bottom, all fore and aft, and has topgallant forecastle, bridge house, and half poop.

River Lagan.—On June 7th Messrs. Robert Duncan & Co., Port Glasgow, launched the iron screw steamer *River Lagan*, for Messrs. James Little & Co., Glasgow. The *RiverLagan* is 208 ft., in length, 29 ft. across the beam, and has 13 ft. 11 in. depth of hold, with a gross tonnage of 800. Messrs. Hutson & Corbett, Glasgow, will supply the engines.

Aberdeenshire—On June 15th, Messrs. Alex. Stephens & Sons launched from their shipbuilding-yard at Govan, for Messrs. Thos. Law & Co., Glasgow, an iron sailing vessel, called the *Aberdeenshire*, of 1,300 tons register, and the following dimensions:—Length, 236 ft.; breadth, 36 ft.; depth, 21 ft. This vessel is fittted with Messrs. Emerson, Walker & Co.'s patent capstan windlass, forms an addition to Messrs. Law's Shire Line of clipper packets, and, when completed, will load on the berth for Calcutta. The ceremony of naming the *Aberdeenshire* was performed by Miss Gray, of Kelvinside.

City of Oxford.—On June 15th, the screw steamship *City of Oxford* was launched from the building-yard of Messrs. Barclay, Curle, and Co., Whiteinch. The *City of Oxford* has been built to the order of Messrs. George Smith & Sons, and will form an addition to their famous City Line of steamers to Calcutta. She is 400 ft. by 43 by 29½, and will register close on 4,000 tons gross. As the vessel began to move on the ways she was named, with the customary ceremony, by Mrs. Smith, widow of the late Mr. Robert Smith.

Elfrida.—On June 15th there was launched from the shipbuilding-yard of Messrs. Ramage and Ferguson, at Leith, a steam yacht of 160 tons, built to the order of W. F. Burnley, Esq., Ericht Bank, Kirn. The dimensions are 120 feet by 17 feet by 10 feet. The engines are compound, having cylinders 13 inches and 27 inches by 22 inches stroke, supplied by the builders. Immediately after the launch the vessel was towed to the Victoria Dock to receive her machinery. The ceremony of naming the steamer *Elfrida* was performed by Miss Margaret Balfour, of Edinburgh.

Rockton.—On June 17th Messrs. Napier, Shanks, and Bell launched from their shipbuilding yard, Yoker, a screw steamer of about 2,000 tons gross, and 1,800-horse power, named the *Rockton*, built to the order of the Australasian Steam Navigation Company of Sydney, New South Wales. The steamer is 270 feet by 37 feet by 24 feet, having accommodation for 140 passengers, and is intended for the Australian coasting service conducted by the company. The machinery, of the most improved type, is supplied by Messrs. John and James Thomson, Glasgow. The naming ceremony was performed by Miss Trouton.

St. Olaf.—On June 17th, there was launched from the shipbuilding yard of Messrs. Murdoch & Murray, Port Glasgow, an iron screw steamer of the following dimensions:—130 ft. by 22 ft. by 12 ft. depth of hold, and built to the highest class in Lloyd's. The vessel has been built to the order of the North of Scotland & Orkney & Shetland Steam Navigation Company, Aberdeen, and is intended for the mail and passenger traffic at the North of Scotland. As the vessel left the ways the ceremony of christening her *St. Olaf*. was performed by Mrs. John Henderson, of Glasgow. The *St. Olaf's* engines are 20 in. and 38 in. by 30 in. stroke, with 90. lbs working pressure, and will be supplied by Messrs. Dunsmuir & Jackson, engineers, Govan.

Talavera.—On June 19th, there was launched at Dumbarton, by Messrs. Birrell, Stenhouse & Co., shipbuilders, a four-masted iron sailing ship of about 1,700 tons nett register, built to the order of Messrs. John Hardie & Co., and others, Glasgow. She was named *Talavera*. by Mrs. Wm. Neilson, Glasgow. The ship will be completed on an early date, and will thereafter take berth at Glasgow to load cargo for Melbourne. and will sail under command of Captain John Robson, late of the *Salamanca*, belonging to the same owners.

Massilia.—On June 19th, Messrs. Scott & Co., Cartsdyke, Greenock, launched from their yard a screw steamer of 3,750 tons, and of the following dimensions:—Length 360 ft., breadth, 43 ft. and depth, 30 ft. Her engines, which are being constructed by the builders of the vessel, are 500-h.p. The new vessel was named the *Massilia*, and has been built for Messrs. Cyprien, Fabre, & Co., of Marseilles. She is fitted up as a cargo-carrying vessel, but is to have accomodation for a limited number of first-class passengers.

Minnard Castle.—On June 19th Messrs. John Fullerton & Co. launched from their yard at Merksworth, Paisley, a screw steamer of about 350 tons, and 500-horse power. The vessel has been built for the Lochfyne & Glasgow Steam Packet Company, and is intended to develope a new trade, both passenger and cargo, between Glasgow, Tarbert, Inverary, and intermediate ports, and will be under the command of Captain Dewar, late of the *Iona*. Her engines and boilers, with all the latest improvements, will be supplied by Mr. William Kemp, engineer, Govan. On leaving the ways she was named the *Minnard Castle* by Miss Graham, Tarbert.

LAUNCH.—IRISH.

Yucatan.—On June 15th there was launched from the iron shipbuilding works of Messrs. Harland & Woolff, Belfast, a screw steamer for the West India and Pacific Steamship Company, of Liverpool. The dimensions are:—Length, 335ft.; breadth, 38ft. 6in.; depth. 26ft. 6in.; gross register of tonnage, about 2,300. The vessel is named the *Yucatan*.

LAUNCH.—GERMAN.

George Dittman.—On May 27th there was launched from the yard of the Flensburg Iron Shipbuilding Company a new screw steamer. She is the fiftieth vessel launched by this company in the few years of its existence, and is of the following dimensions:—160ft. by 22ft. 11½in. by 13ft. by 7½. Her engines are on the compound principle of 60 N.H.P. She is classed in the first Division Veritas. She belongs to the Flensburg Iron Shipbuilding Company, and is intended for carrying ship's plates, angles, bulbs, &c. On the launch day the whole of the yard was decorated with branches of trees and flags. As she left the ways she was christened the *George Dittman* by Miss G. Dittman. About 1½ hours after the launch the keel for No. 53 (s.s.) was laid in the same birth as No. 50 had.

LAUNCHES.—SWEDISH.

Kong Ring.—On April 15th at Kockums Mekaniska Werkslads Aklie Bolag Malmo the *Kong Ring* was launched. This vessel is to the order of the Sondenfjeldske Dampskibs-Selskab of Christiania and is intended for passenger and goods trade between Christiania and Hamburg. Her dimensions are:—223ft. long, 30ft. beam, and 22½ft. depth. She is spar-decked, built to Lloyd's survey 100 A 1, and is fitted to accommodate 30 first and 12 second-class passengers, and to carry 1,000 tons deadweight. Engines of about 800 indicated horse power will be supplied by the builders.

Sokrates.—On June 2nd the Motala Company successfully launched from their yard at Lindholmen, near Gothenburg, a twin screw steel steamer, the first of four sister ships under building for carrying petroleum in bulk. The principal dimensions are as follows:—Length, 252ft. 6in.; breadth, 28ft. 6in.; depth of tank, 11ft., and the carrying capacity will be 52,000 purd of oil. The *Sokrates* will be fitted with a pair of compound engines of 60 nominal horse power, and when complete sent through Russia down to the Caspian Sea.

Fellus.—The steamer was launched from the Motala Company's yard at Norr Roping on May 23rd. She will be owned by the Stockholms Angfartygs Rederi Bolag, and is intended for the Mediterranean and Baltic Trade. *Fellus* is of the following dimensions:—Length, 222ft.; breadth, 31ft. 6in.; and depth of hold, 17ft. 3in. Will get the highest class at Veritas. Her engines will immediately be shipped.

LAUNCH.—FINLAND.

Zuruhan.—On June 13th Messrs. Wm. Crichton & Co. launched from their shipbuilding yard at Abo, Finland, an iron screw steamer, built for a company in St. Petersburg for the transport of naphtha on the Caspian Sea. This steamer, which has the highest class French Lloyd's, is of the following dimensions:—Length, 210ft.; breadth, 28 ft.; depth of hold, 14 ft. 6 in.; with a draught of 9 ft. 6 in. She is built in two parts in order to enable her to get through the so-called canal system. She is to be fitted with a compound surface condensing engine of 360 indicated horse power, water ballast, steam winches, and all the latest improvements. She is the largest iron vessel built in Finland to this date.

TRIAL TRIPS.

La Capital.—On May 20th, the light draught turn screw steamer, *La Capital*, built by Messrs. Edwards & Symes, of Cubitt Town, London, E., for the Government of the Argentine Republic, proceeded on her official trial trip, her draught of water aft being only 4 ft., her propelling machinery being two independent sets of compound surface condensing engines of the ordinary type, and multitubular marine boilers, which worked most satisfactorily, maintaining a steam pressure of 95 lb., and the vessel attained a mean speed on the measured mile of nearly 12 knots, although under very unfavourable conditions of weather for a light draught vessel.—Since the above date, on June 8th., the twin screw steamer, *La Capital*, proceeded down to Long Reach for her second official trial, having been loaded with 22 tons of cargo; mean draught of water 4 ft. mean speed; attained on six consecutive runs was 11 knots, having more than fulfilled the expectations of her builders; and the contract speed, the results of the trial trips of the above vessel of so light a draught, the builders deserve hearty congratulations.

Lymington.—On the 24th May, the *s s. Lymington*, built by Messrs. Edwards & Symes, and engined by Messrs. Burrell & Sons, of Tetford, proceeded on her trial trip; her dimensions are of 110 ft. long between perpendiculars 18 ft. beam, and 10 ft. deep, and classed 20 years in red in Liverpool Registry of Iron ships.

Lamport.—On Wednesday, June 21st., the steamer *Lamport*, belonging to Messrs. A. Holland & Co., London, went upon her trial trip off the Tyne. The vessel is 317 ft. long, and 37 ft. beam and is capable of carrying 3,700 tons dead weight. She has engines of 250 nominal horse-power by Messrs. Hawthorn, of Newcastle, and is fitted with steam steering gear, distilled, steam starting gear, and an unusually liberal outfit of spare gear. The vessel has been built under the superintendence of Mr. J. F. Flannery, consulting engineer, who also represented the owners on the trial. The speed at loaded draught was equal to 11 knots, which was considered extremely satisfactory.

Morning Star.—The screw-steamer *Morning Star*, built by Messrs. Irvine & Co., and owned by Messrs. Johnson, Bros. & Co., of West Hartlepool and Cardiff, had her trial trip on June 17th. The steamer proceeded for a run of four hours, and attained the speed of 10½ knots per hour, the ship and engines giving every satisfaction. The vessel has been built under the owners' supervision, and is intended for general light draught trades, with a dead weight carrying capacity of about 1,506 tons. She is fitted with steam steering gear; Emerson and Walker's patent windlass, three steam-winches, and all the latest improvements. After an exceedingly fine run along the coast, the *Morning Star* steamed direct to Bilbao in water ballast, under the command of Captain Robert Verrill.

Cordelia.—The *Cordelia*, one of the new unarmoured corvettes of the *Comus* class, recently built at Portsmouth, lately made an official six hours' full power trial of her machinery at the back of the Isle of Wight. Among those on board watching the trial were Captain Colomb, of the Steam Reserve, Mr. John Oliver and Mr. Butler, of the steam department at the Admiralty, and Mr. Morcom, of the factory branch of the dockyard. The trial itself was conducted by Mr. Phillips, for the contractors, Messrs. J. and G. Rennie, of London, the latter of whom was also in attendance. The engines are of the same "tandem" pattern as those of the Canada, by the same firm. They are constructed to develop 2,300-horse power, and are of the horizontal compound type, having four cylinders, each high-pressure cylinder being at the back of, and working in conjunction with, its respective low-pressure cylinder. Two of the cylinders are 36 in. in diameter and the others 64 in., the stroke being 2 ft. 6 in. The crank shaft is in two separate halves, and arrangements are made so that low-pressure steam may be admitted to all the cylinders direct from the boilers. The surface condensers have a total condensing surface of 5,000 square feet, which steam is furnished by six boilers which have a beating surface of about 6,000 square feet. Engines of this pattern have given great satisfaction at sea, and the Messrs. Rennie have received the contract to fit them to the *Calliope* and the *Calypso*, which are now under construction, the former at Portsmouth and the latter at Chatham. These vessels are of the same class of ship as the *Cordelia*, but, for the purpose of realizing a higher rate of speed, they are to be built 10 ft., longer and to possess greater steam power. The engines are to be of 3,000 horses and in order to bring them up to the requirements of the day their power is to be increased by the adoption of a partial forced blast. The *Cordelia* was brought down by iron ballast to a draught of 14 ft. 4 in. forward and 18 ft. aft, or about 2 ft. less than her mean load-line, so that the propeller had plenty of water to thrust upon. From the beginning to the end of the six hours' continuous full-power run, the engines worked with great regularity and uniformity of power and revolutions, without any indications of heated bearings being noted. The *maximum* power shown by the cards at any one time was 2,493·26 and the *minimum* 2,339·55 horses, the mean power of the 12 half-hourly observations being 2,423.53, or 123½ horses beyond the power contracted for, and only six horses below the mean power realized during the trial of the sister ship *Canada*. The mean pressure in the boilers was 60·12 lb., the vacuum 26·64 in. and 26 61 in., and the vevolutions per minute 105½. The speed realized, as tested by service log and cross bearings, was 14·25 knots. It may be mentioned that 352 cwt. of coal was consumed during the six hours' steaming, which represented 2·73 lb. to every unit of power developed. The trial was in every sense very satisfactory. At the end of the full-power run the engines were worked for the purpose of ascertaining whether, in case one of the feed pumps were disabled, the other would suffice to supply the whole of the boilers. It was found to be amply sufficient. At previous trials 863·17-horse power was indicated with the jet injection in use, 1,539·54 with the expansion valve cutting off at one-sixth of the stroke, and 1,144·52 with the engine working as simple engines. At the end of the trial the *Cordelia* steamed into harbour to complete. Some additional ventilation will have to be given to the engine-room and stokeholds. A new contrivance, the invention of Captain Colomb, has been fitted for communicating orally with all parts of the ship at once, and it is intended to construct gun platforms on both sides of her forward for 6 in. breech-loaders, mounted on the Vavasour principle, for securing fore-and-aft and cross fire.

Sultan.—After a couple of failures due to the heating of her crank bearings, the *Sultan* made a successful full-power three hours' trial of her engines on May 31, outside the Warner. The spare brasses had been fitted to the after crankhead since the last run, while the damaged brasses had been refitted with white metal as duplicates. The trial began at ten o'clock. The mean draught was 26 feet 4 inches. Boilers and engines worked very satisfacto ily, The mean vacuum in the condensers was 26½ inches, and 25½ inches, and with a mean of 67·7 revolutions she realised a speed of 14 knots and developed 7,126·27 horse power. The mean boiler pressure was 32 lb. The *Sultan* will leave to join the Channel Squadron at Plymouth at daybreak on Saturday, and will make a continuous six hours' full-power trial on her way down Channel.

Dandolo.—The Italian turret-ship *Dandolo* left her moorings at Spezia at 10 o'clock on June 6, on a trial trip at, the measured mile. Full steam was ready at 10.45, and the satisfactory result of a speed of full 15 6-10 knots was obtained, with an indicated power of 8,263 horses from the engines. The pressure of 62 lb. of steam in the engine room was easily maintained with the natural chimney draft. The vacuum in the condensers was 27¼ to 27½. Later in the day the engines were worked with half boilers, and a speed of about 12 knots was easily obtained, with great regularity and economy of fuel.

The Mentmore.—This screw steamer, which was launched in February last from the yard of Messrs. Kay & Son, Kinghorn, sailed down the Firth of Forth on her trial trip on May 22nd, under the command of Captain Amlet, Commodore of the Johnston line of steamers. The *Mentmore* is a vessel of about 4,000 tons burthen, and was built to the order of Messrs. Johnston & Co., Liverpool, for the Atlantic trade. She was fitted with engines of 300 horse power nominal by the builders, at Leith, and on her trial trip, which was most satisfactory throughout, attained a speed of 13 knots.

The Cyphrenes.—On May 27th this screw steamship, which belongs to Messrs. William Wheatley & Co.'s line, went on a trial trip, having been fitted with a pair of steel boilers made by Messrs. James Jack & Co., of Liverpool, by whom also the engines were thoroughly overhauled, under the superintendence of Mr. W. Esplin, consulting engineer. The trip was most satisfactory, showing the following results:—She steamed the measured mile, against a steady head wind, at a speed of 12¾ knots, and on the run home she did 15 knots, or, allowing for the tide, about 13¾ knots actual steaming. The revolutions were 75 per minute, on 75 lb. steam.

Scaramanga (s).—On May 27th the trial trip of the *Scaramanga* (s), built for Messrs. Scaramanga & Co., London, &c., by Messrs. C. S. Swan & Hunter, Wallsend, took place, when a satisfactory speed was attained, and the trial was considered by the owners to be very successful. The steamer will carry about 2,100 tons deadweight, and has engines by the Wallsend Slipway & Engineering Company (Limited).

The Ho-nam.—The end of May, the paddle steamer *Ho-nam* proceeded down the Firth of Clyde on an experimental cruise. The new vessel was constrocted by Messrs. A. & J. Inglis, Pointhouse, for the Hong Kong, Canton, and Macao Steamboat Company, and she is intended for passenger service between Hong Kong and Canton. She is 280 ft. long, 73 ft. broad, and 30 ft. in depth to the uppper deck. Her gross tonnage is 2,364 tons, and she possesses accommodation for about 2,000 passengers. In outward appearance she bears a strong resemblance to an American river steamer, the promenade and saloon deck rising to a considerable height above the bulwarks, and covering the whole vessel fore and aft. There are altogether three decks—the main, promenade, and saloon. The engine is also of a novel construction, being a compound beam engine of about 3,000 indicated horse-power, the cylinders being 40 in. and 72 in. by 10 ft. stroke. The paddle-wheels are fitted with feathering aparatus and steel floats. The *Ho-nam* attained a speed of 16,142 knots on the measured mile at Skelmorlie. The speed trial having been completed, the consumption of fuel was carefully measured for several hours, a mean speed of 15 knots being maintained during the whole time. The result of this trial was also highly satisfactory, being well within the contract limit. The vessel proceeds to China under command of Captain Barnett.

Oslo.—On May 30th, this steamer, built at the Kockum Works, at Malmö, went on her trial trip. She is to load 1,160 tons with a draught of 15 ft. of water and a coal consumption of 1000 lb. the hour, which conditions were fulfilled at her trial, the furnaces consuming 160 lb. of coals less than contracted for. The vessel, which is built for trading, is fitted with engines of 550 h.p. She belongs to the Kristiania Dampskibsselskab of Christiania.

Sarah.—On June 1st, this new screw-steamer, of 2100 tons deadweight carrying capacity, which has been built by Messrs. J. Redhead & Sons. of South Shields, to the order of Messrs. R. Harrowing & Co., of Whitby, made a most succesful trip, from the Tyne along the coast southwards.

Kasi.—On June 1st, there was made on the Clyde the official trial trip of the paddle-tug steamer *Kasi.* Built and engined by Messrs. D. J. Dunlop & Co., the *Kasi.* has been designed for a very special kind of work on the river Ganges. Although only a towing boat, the *Kasi* is a steamer of somewhat considerable proportions, her length being 145 ft. breadth 23 ft. and depth of hold 8 ft.; and she is of most unusual strength. She is fitted with two pairs of compound and surface-condensing engines of the tandem and disconnecting type, the low and high pressure cylinders being respectively 21 in. and 39 in. in diameter, with a piston and stroke of 4 ft. 9 in. in length. As tried on the measured mile at Skelmorlie the *Kasi* attained a speed of 12 knots an hour, and her engines gave out 700-h.p. indicated, while going at 38½ revolutions per minute. Primarily she is to be used for towing purposes on the Ganges at the great bridge now building over that river at Benares to connect the Oude and Rohilcund Railway with the East Indian Railway at a cost of probably half a million sterling. With the assistance of four pontoons (also built at Glasgow) the tug steamer *Kasi* will in the first instance be employed in towing those girders out from the land where they are being built and in assisting to put them into position at a great height above the water. In every sense of the term the *Kasi* proved herself to be a creditable piece of Clyde skill and workmanship, her rigidity being such that not a trace of vibration could be perceived, even when the fullest power was being developed by her engines. The *Kasi* will steam out to Calcutta via the Suez Canal.

The Dora Tully.—On June 1st the new steamer *Dora Tully,* the latest addition to Messrs. Tully and Co.'s fleet of steamers, went out of the Tyne for her official trial trip. She was favoured by exceedingly fine weather, and the trials proved most satisfactory. The vessel, which is named after a daughter of the managing owner, was built by the Tyne Iron Shipbuilding Company. In her build and fit out are concentrated all the requirements of a cargo steamer, *i.e.*, speed, large carrying power, and economy in working. Her dimensions are 375 ft. by 37 ft. 6 in. beam, by 20ft. 6in. in depth. She has a pair of Messrs. Hawthorne's engines, of 250 horse power, and her carrying capacity is 2,500 tons. She has topgallant forecastle, long bridge (70 ft.) protecting the engine-room amidships, and full poop aft, in which are the state-room and officers' quarters. On being put over the measured mile a mean speed of eleven knots was obtained, the engines indicating 1,110 horse power. The vessel is steered by one of Messrs. Amos and Smith's steam apparatus, of Hull. The *Dora Tully* steamed away from the bar shortly before 6, bound for Venice.

TRIAL TRIPS.—SWEDISH.

Mercuri.—On May 23rd this steamer left the yard at Lindholmen, near Gothenburg, for St. Petersburg, when she was handed over to the owner, Mr. Merkuhiff, of Astrakan Russia. The *Mercuri*, which is intended for carrying petroleum in bulk, was launched in March last, and is of the following dimensions:—Length, 250 ft.; breadth, 28 ft. 6 in.; depth of tanks, 11 ft. During the trip her pair of compound engines worked satisfactorily, giving the ship a speed of nearly 10 knots.

Ozernoi.—On May 13th this steamer, which a short time ago was launched from the Motala Company's yard, at Norrkoping, under her trial trip. The principle dimensions are:—Length, 137 ft.; breadth, 19 ft.; draught of water, fore 4 ft. 3 in., aft. 4 ft. 6 in. The speed attained was 11 knots. The *Ozernoi* was built for the Russian Government, which will use her for inspections of the Russian canal system.

Oslo.—This vessel, recently completed for the Christiania Dampskibs-Selskab, by Kockums Mekaniska Werskslads Aklie Bolag, Malmo, was successfully tried on the 12 knots course in the Sound on May 23rd. The vessel measures 225 ft. by 31 ft. by 15 ft. 25 in. She is spar-decked, and built to Lloyd's survey class 100 A 1. The engines, constructed by the shipbuilders, are of the usual inverted direct acting type, cylinders 28 and 40, and stroke 30 in. With the machinery developing about 530 I.H.P., going at 79 revolutions, a speed of 10½ knots was easily maintained. The consumption of coal under these conditions being 960 Norwegian pounds per hour.

TRIAL TRIP.—GERMAN.

Stern.—On June 3rd the screw steamer *Stern*, built and engineered by the Flensburg Iron Shipbuilding Company to the order of Messrs. Holm & Molzen, ran her trial trip over the measured mile in the Bay. Her dimensions are:—200 ft. by 28 ft. 8 in. by 15 ft. 1 in. Her engines, which are 80 N.H.P., were sufficient to propel the vessel at the rate of 9½ knots an hour, using 7¼ tons of coals per 24 hours. At the trial trip everything worked to the entire satisfaction of all on board.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

To the Editor of THE MARINE ENGINEER.

SIR,—Will any of your readers give me an idea of the best way to destroy the corrosive action of feed water before it leaves the hotwell.

Yours truly,

June 26th, 1882. WAVE.

To the Editor of The Marine Engineer.

Sir,—I beg to present my compliments to you, with a few words about the Navy in the pamphlet enclosed. If you are as patriotic as I hope and believe, I trust that I may enlist your sympathy and assistance in the great work I advocate. It is time we were up and doing. Kindly publish the enclosed letter.

Yours,
THOMAS M. C. SYMONDS.
Torquay, *June 16th*, 1882.

To the Editor of the *Edinburgh Review*.

Sir,—I always greatly enjoy reading the *Edinburgh Review;* but various pressing business has delayed my seeing the current number till to-day, when I have read the article, "Sir Thomas Brassey on the British Navy."

The article contains the following sentence, "Sir Thomas Symond's opinion on professional matters necessarily carried great weight, more especially in the minds of those who, knowing his high reputation and distinguished service, were ignorant of the peculiar circumstances which had embittered his spirit, and led him to look with jaundiced eyes on everything connected with Admiralty administration." Any thing and every thing that I have written is the honest expression of my best judgment and had underneath it no other motive than love of my country and of the noble service to which my life has been given. None could act on the motive imputed falsely to me by your reviewer, unless he were a dirty dishonourable knave. I am quite sure that the close of the sentence which I have quoted must have escaped your notice, and that the *Edinburgh Review* is not one in which an anonymous writer can shelter himself, while making a gross personal and false attack on the honour of an old admiral of the fleet who has served his country, not without esteem and honour, for the last sixty years. Such a personal attack may be a convenient way of answering my statements, but is neither argument nor proof; and it reminds me of the old instructions:—"No case, abuse plaintiff's attorney." In a sentence from a pamphlet (which I shall send to you shortly) printed before I saw the article in your *Review*, I say, "I have held almost every post, and received every honour possible to me, and I have, as regards myself, not one professional wish ungratified." This, written many weeks ago, will show how little truth there is in the offensive attack upon my honour, which your *Review* has published to the world. I think that you will yourself see that some public retraction of that attack is due from so honourable a review. But that I can safely leave to your own high sense of courtesy and honour.

I am, dear sir,
Very faithfully yours,
THOMAS M. C. SYMONDS,
Torquay, *June 13th*, 1882. Admiral of the Fleet.

To the Editor of The Marine Engineer.

Dear Sir,—We would wish to add to the description of the s.s. *Vice-Admiral Albuquerque*, published by you on the 4th ult., that we attribute the great success we had with her, as regards speed, entirely due to the use of "Wrench's Patent Oblique-Bladed Propeller," which was used on the occasion. We have had several occasions of testifying to the extraordinary results obtained with this propeller above any other. In the case of the steam launch *Mabel*, built by us, we had guaranteed 11 knots, and found, with the propeller we had out from our agents in England, supposed to be the most suitable for the lines of the boat, and the power supplied we could not get more than 8½ knots. We had the use of the most improved propeller pattern for launches and torpedo boats from the Indian Government Dockyard, Bombay, through the kindness of Mr. Wood, the Inspector of Machinery, but they were useless. On applying one of Mr. Wrench's propellers, specially constructed to suit the launch, we at once got 11½ knots without any alterations whatever to the engines.

We have this last week fitted the propeller to the s.s. *Drani*, built on the Neegas Patent Slip, Bombay, and engined by Mr. Adam Millar, London, with twin screw engines, compound surface-condensing, inverted cylinder type, fitted with latest improved propeller, sent out with the engines. On her trial the greatest speed attainable was 4 knots. On applying Wrench's patent 4-bladed propeller, 6 feet pitch, 120 revolutions per minute, we at once got 8 knots, the guaranteed speed. Mr. Wrench has gone to England to push his patent, and we have no doubt it will give as satisfactory results in England as in India.

It has a great advantage over the ordinary solid propellers, that the blades are loose, and in case of breakage a new blade can be at once attached.

We beg to send you herewith a description of the same, and trust you will find space for a description of the same. Being an entire departure from the ordinary description of propellers, it may open up a fruitful field of discussion.

We are, dear sir,
Yours truly,
FRASER & MILLER.
Carnac Iron Works, Bombay.

A New Torpedo Boat.—The *Novoe Vremya* gives an account of a new submarine boat, the invention of M. Dgevetsky, which has recently been submitted to trials at Cronstadt. Some previous experiments had already been conducted in the Black Sea, and the Ministry of Marine considered the result so important that they assigned a sum of money to cover the construction of 50 boats of this design. These boats are now completed, and some of them have been despatched to the Black Sea, and the rest are retained for service in the Baltic. The proportions of these vesssls are very small, being from about 15 ft. to 20 ft. in length, but of sufficient weight and bulk to effect their purpose of subaqueous attack. The weight of each is not more than 150 poods, and is such, therefore, as to admit of every man-of-war having several of them on board. The last examples have been fitted with appliances by means of which they may be hoisted on deck like ordinary ships' boats. The subaqueous boat of M. Dgevetsky has the form of a cigar; its screw propellor is moved by the feet of four men placed in the central part of the vessel beneath a small glass dome, through which the officer in command can see the submerged portion of the enemy's vessel, and accordingly direct the attack. The speed attainable by these boats is four miles an hour, which, it is considered, is amply sufficient to enable a subaqueous attack to be made upon vessels lying at anchor or approaching. The steerage of the boat presents no difficulty. To lower it to the distance of 50 ft. and to raise it again to the surface of the water, is rendered an easy operation by a very ingenious device. This elevation or depression is effected by means of weights made to slide upon longitudinal, horizontal bars or guide rails. When the boat is fully stored, charged, and equipped, its normal position is just beneath the surface of the water, the upper portion of the glass dome alone slightly emerging. When it is desired to sink to a certain depth, the weights are slid forward to the prow of the boat, which, upon the propeller being set in motion, immediately begins to descend. The depths attained are shown by a specially constructed manometer. As soon as the boat has reached the desired depth, the weight is moved back to the centre of the boat, and the latter now takes a horizontal direction. In order to rise to the surface, the weight is slid back to the stern, and thus an upward direction is communicated to the motion of the boat. Each of these boats is provided with a couple of mines or torpedoes, attached to it by means of levers. As soon as the boat passes underneath an enemy's ship these can be instantly detached, and are so constructed as to mount upwards and, by means of a gutta-percha appliance, attach themselves pneumatically to the enemy's hull. The attacking boat then retires to a safe distance, paying out at the same time the electrode wires in connection with the torpedo, which is then exploded. A supply of air compressed to a fiftieth of its normal volume is kept in a strong reservoir for the inhalation of the crew manœuvring the subaqueous vessel, and is emitted by valves of a particular construction. Sufficient air is stored in this way to last 24 hours; the exhaled gases are at the same time absorbed by chemical means. Such are the general features of this new invention. M. Dgevetsky, who is at present in Paris, is said to be devising means of applying electricity as the motive power in these boats, and thus considerably increase their speed.

Zinc Sheathing for Iron Ships.—On May 4th there was launched from the yard of Messrs. William Denny & Bros., Dumbarton, a small screw steamer of about 60 tons gross register, named the *Snerk*, intended for service as a tender in connection with the vessels built by the firm, while under completion, and perhaps lying at a distance. The launch of this little vessel is somewhat noteworthy, inasmuch as that in her construction a feature has been adopted which may yet have an important bearing on the question of the preservation of iron and steel vessels from the fouling and corrosion incident to sea voyages. This is the attachment of zinc sheathing to the bare shell plates by the process patented by Mr. J. J. Atkinson, of Brackley. This is the second or third vessel to which Mr. Atkinson's process of zinc sheathing has been applied, one being the s.s. *Bessie*, built by Messrs. T. B. Seath & Co., of Rutherglen, about a year and a half ago. The process consists in fitting thin zinc sheets, of about the size of ordinary shell plates, over the bare shell, the attachment being by solder applied first to spots prepared by an electro-dynamo machine on the shell of the vessel, and then over the same spots when the sheathing has been fitted. Holes are perforated in the sheathing a little less than the than the diameter of, but made to correspond with, the prepared spots on the shell, which are spaced every way about 8 or 9 inches apart—and the application of solder after the sheathing has been fitted results in the fusion of the outer and the inner layers of solder, and, consequently, the zinc sheathing between. The landing edges and laps of the several strakes of zinc plates are soldered throughout, the whole presenting a surface smoother than the most carefully sheathed wooden ship, and not much behind iron vessels with finishing coat of anti-fouling paint. The strong galvanic action incident to the conjunction of iron and zinc is a matter of common knowledge, and although the utilization of this knowledge for the purpose of ship-coating is not wholly new, the manner in which it is done by Mr. Atkinson's process removes almost entirely the objections to its adoption from an economic as well as a practical shipbuilder's point of view. The waste of the zinc, while not inconveniently rapid, is constant and effective as throwing off all species of fouling. One of the vessels already fitted with zinc has been docked at intervals, and the state of the sheathed portion of the bottom has been found invariably to be clean and in every respect satisfactory; while it has been observed that a streak of the bare shell above the sheathing, which had been submerged, is always thickly incrustated with barnacles and other species of fouling. The result of the application of the process in the present instance will be regarded with interest.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 23rd May to 22nd June.

2424 A. W. Pattie and G. W. Robertson. Engines for steering, starting, and general purposes.

2440 L. J. Wing (communicated to H. J. Haddan). Rotary engines.

2465 J. W. Joyce. Slide valves.

2476 W. Southwood. Rotary engines.

2495 W. H. Willats. Fog signals, &c.

2496 T. Nordenfelt. Breech-loading ordnance.

2497 C. A. McEvoy. Projectiles.

2533 R. Turnbull. Pontoon docks and ship ways.

2548 J. A. McClellan. Steam boiler.

2552 J. Cook and W. Prosser. Steering quadrants or tillers.

2555 F. Barnett. Blocking submarine tunnels.

2564 E. Moxon. Construction of barges, &c.

2583 W. H. Allen and others. Starting, stopping, and reversing engines.

2598 W. Cooper and J. Holdsworth. Loading and unloading bulk cargoes, and dredging, &c.

2607 W. K. Lindsay. Bridge floorings.

2648 H. Westman. Bathing machines.

2671 J. Selwig (communicated to W. P. Thompson). Centrifugal governors.

2677 R. Hodson. Rotary engines.

2684 A. Nickells. Steerage berths.

2691 N. McMillan (communicated to D. McMillan). Boiler tube stopper.

2726 A. H. L. Oudry (communicated to A. M. Clark). Bilge water alarms.

2747 W. H. Hall. Rigging of sailing vessels.

2789 J. Howden. Furnace air supply.

2796 W. Teague. Buoyant speed wheel.

2809 J. and F. W. Brierley. Rotary engines.

2822 J. Littlejohn. Pontoon deck-house.

2841 A. D. Barclay. Steam boilers.

2842 R. Atkin. Construction, propulsion, and steering of vessels.

2869 M. Cotter. Ships' rudders.

2877 L. G. C. de Nordeck (communicated to W. R. Lake.) Electrical apparatus for ascertaining depth of water.

2888 S. Baxter. Capstans, windlasses, cable holders, and riding bitts.

2899 R. A. Ray. Easing strains on sheets of fore and aft rigged vessels.

2915 W. J. Brewer. Hoisting gear.

2968 W. C. Cowie. Propelling vessels.

2973 R. Boyle. Ventilators.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

ERROR IN MAY NUMBER.

April 15th, 1882.

Snowdon, John	1 C	London.

May 27th, 1882.

Anderson, Thos.	2 C	Lvrpool.
Boyd, David M.	2 C	Glasgow.
Bremner, Thos.	2 C	do.
Bryars, Robert	2 C	do.
Carr, Andrew ...	1 C	N Shlds.
Catterick, Thos.	1 C	do.
Dunn, John ...	2 C	do.
Evans, Richard	1 C	Lvrpool.
Fleming, John...	2 C	Lvrpool.
George, Edward	1 C	N Shlds.
Gordon, James...	1 C	Glasgow.
Heckels, R. A.	1 C	N Shlds.
Hedderwick, P.	2 C	Glasgow.
Houston, Walter	1 C	London.
Hyde, Alexander	2 C	N Shlds.
Lawson, John W.	1 C	do.
Liddell, Henry	2 C	do.
McKellar, Arbd.	2 C	Glasgow.
Moffatt, John ...	1 C	Lvrpool.
Niven, Wm. A.	2 C	Glasgow.
Organ, Wm. Jno.	2 C	London.
Parkinson, John	1 C	N Shlds.
Robinson, T. W.	2 C	London.
Stones, Matthew	1 C	N Shlds.
Stranghan, Morton	2 C	do.
Tully, William	1 C	London.
Wilson, William	2 C	N Shlds.

June 3rd, 1882.

Almond, H. J. ...	1 C	Sndrlnd.
Berntsen, Wm. F.	2 C	Lvrpool.
Dick, J. Norman	1 C	Lvrpool.
Eliot, Regld. P.	2 C	London.
Fairburn, S.A.C.	2 C	Lvrpool.
Good, Farrant ...	1 C	Bristol.
Gordon, James...	1 C	Sndrlnd.
Hunter, Chas. H.	1 C	do.
Lockie, John ...	2 C	do.
McCredie, David	2 C	Lvrpool.
Morgan, Thos.	2 C	Bristol.
Reid, James M.	1 C	Lvrpool.
White, Thos. J.	2 C	London.
Whyte, Andw. L.	2 C	Lvrpool.
Williamson, J.E.	2 C	Bristol.
Woods, A. R.T.	2 C	Lvrpool.

June 10th, 1882.

Adamson, Wm.	2 C	N Shlds.
Axford, Thos. M.	1 C	London.
Betts, Wm. G....	2 C	Hull.
Cross, Robert H	2 C	London.
Denbigh, Geo. E.	1 C	do.
Dunbar, Arthur	2 C	Greenock
Edge, Alfred ...	2 C	N Shlds.
Fisher, Mario ...	1 C	London.
Fuller, Richd. B.	2 C	Hull.
Hunt, Thomas ...	2 C	do.
Marley, Chas. C.	1 C	N Shlds.
Marshall, Wm.	2 C	Sndrlnd.
Tweedy, Jacob...	1 C	N Shlds.
Ward, William	2 C	Hull.
Watt, Alexander	2 C	London.
Watters, Wm. H.	2 C	do.

June 17th, 1882.

Barrett, John J.	1 C	London.
Bowman, Wm.	1 C	Leith.
Chaloner, Jno. A.	2 C	Lvrpool.
Ferguson, James	1 C	do.
Fowler, James...	1 C	do.
Gilroy, George...	2 C	Leith.
Grieve, Thomas	1 C	do.
Heaton, Edward	1 C	Lvrpool.
Hutchinson, W.J.	2 C	Lvrpool.
Kelly, Thomas...	2 C	N Shlds.
Kendall, Thomas	2 C	Lvrpool.
Lace, William ...	2 C	do.
McEwan, Alex.	1 C	Leith.
McIntosh, Dnld.	1 C	Lvrpool.
Meldrum, Thos.	2 C	N Shlds.
Mowbray, Ralph	1 C	N Shlds.
O'Brien, Benj. T.	1 C	Lvrpool.
Paterson, G. K.	1 C	Leith.
Paxton, Thomas	2 C	Leith.
Priestley, Ths. M.	2 C	Lvrpool.
Roxburgh, Chas.	2 C	Leith.
Scott, John ...	2 C	do.
Shillinglaw, Rbt.	2 C	do.
Side, Soren A....	1 C	N Shlds.
Wade, Robert ...	1 C	Lvrpool.

LAUNCH AT LINTHOUSE.—INTERESTING PROCEEDINGS.—There was launched on the 21st of June, at Linthouse, a very beautiful steam yacht, built by Messrs. Alex. Stephen & Sons, for the senior partner of that firm, Mr. Alex. Stephen, Lord Dean of Guild, and the vessel was named the *Sylvia* by Mrs. Stephen. Subsequently cake and wine were served in the model room, and, after "Success to the *Sylvia*" had been duly pledged along with other toasts, Mr. William Gray, blacksmith—who appeared in shirt sleeves and leather apron—on behalf of the firm's employés, who were largely represented in the company, presented Miss Maud Stephen with an elegant diamond necklace in an oak casket, silver mounted, and bearing a suitable inscription. In doing so, Mr. Gray expressed briefly, but very happily, the feelings of respect and esteem entertained by the workmen towards Mr. Stephen as an employer and as a citizen, and their hearty and spontaneous desire to take the opportunity of shewing their good wishes for his daughter in view of her approaching marriage. The Dean of Guild replied, thanking Mr. Gray and the subscribers for their very handsome and beautiful gift to his daughter, expressing on her behalf the special interest which would always attach to it, and adding that it had come upon himself as a pleasant surprise, but most gratifying, because he regarded it as an indication of the mutual respect and goodwill it had always been his desire to see between employers and employed.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

ADVERTISEMENTS.

All Advertisements and Business communications must be addressed to the PUBLISHER, 3, Amen Corner, Paternoster Row, London, E.C., to whom all complaints respecting irregularities in delivery should be addressed. Advertisements must be sent in not later than the 25th of each month to ensure insertion in the following number.

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" " Whole page	120s.

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SUBSCRIPTIONS.

The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, AUGUST 1, 1882.

EDITORIAL NOTES.

Mr. ADAM MILLER, of 2, Riches Court, Lime Street, London, has drawn our attention to a letter published in our impression of July, in the Correspondence column, the statements of which he considers to impugn the results of Propellers supplied by him. We regret exceedingly that such a letter should have been published caculated to injure any one's business. We trust that Mr. Miller will accept our apology for so doing in this matter, and hope that his business will not be damaged in any way by the publication of the said letter.

The late bombardment of Alexandria has been an important experience in the value and uses of an iron-clad navy. We think the general impression amongst engineers must be that the protection of men of war by iron or steel armour has very much reversed the relative position of navies and coast defences. It is not so long ago but that it is still fresh in our memories that our famous wooden walls made a long, gallant, but effectual attack upon the harbour defences of Cronstadt and Sebastopol. Wooden vessels were no match then for stone forts or even earth-works. Now it is apparent that stone walls or earth-works are no match for iron vessels. There are, however, several points to be made allowance for in the above conclusion. First, the guns on the forts were not nearly so heavy as those on the ships. We might have had a different tale to tell had we had 38 and 80-ton guns opposed to us. Secondly, the guns of the enemy were not served or worked with anything like the precision of our own, or the damage done to the ironclads might have been far greater. We think also that the protection of case-mated batteries is much greater than that of open, barbette or embrasured batteries, and that, therefore, the Egyptians fought under great disadvantages.

Some little anxiety was felt amongst technical circles as to the efficiency and reliability of our great guns on board ship, from the report of the failure of two guns on board the *Alexandra* during the bombardment. There is no doubt we have much to learn yet respecting the best mode of manufacture of big guns, and we have often advocated a more energetic test and trial of a homogeneous metal such as compressed steel in place of the complicated forged and welded rings forming the present Woolwich system. We are so far justified in our opinion as we find that one of the guns we refer to, an 18-ton gun, started one of the muzzle rings about 1-100 of an inch. Although this did not cause the gun to go out of action, from the unimportant position of the ring, it plainly indicated that the welds were not sound, and if it was the case at the muzzle, it might equally prove the case anywhere else in the gun. A patchwork system of an infinitely large number of welded pieces must surely be unsuitable for rough work. The other gun, one of 25 tons, was subjected to the dangerous mischance of a shell breaking up in the barrel. On examination it was found that the inner steel tube of the barrel had developed a longitudinal slit. This is certainly a serious matter, and cause for grave anxiety as to the life of our new guns under prolonged fire. As the *Alexandra* had also expended all her common shell with the exception of fifteen, it is perhaps as well that the bombardment was not further prolonged.

We see that smackowners and fishermen of the East Coast are regretting the "good old times" when a man could scarcely call his life, and certainly not his liberty his own. It seems that it has been an old custom amongst the fisheries for the smackowners and fishermen to have the power of imprisonment over those fishermen who desired to leave their work, or as the employers put it who "deserted." A deputation from the smackowners and fishermen waited upon the President of the Board of Trade, Mr. Chamberlain, to point out that the Merchant Shipping Act of 1880 has abolished the penalty of imprisonment for desertion, and that the result has been an enormous increase of desertions amongst the fishermen reaching as much 25 per cent. of the whole men employed. We don't think they deserved a more comforting reply than that they got from Mr. Chamberlain, which was to the effect that there must be something radically wrong amongst the trade and the employers to cause 25 per cent. of desertions. There is nothing more marked in the present progress of civilization than the fact that no man shall be driven to do what he does not like, or what he is not adequately paid for. Let an employer make it worth a man's while to work at reasonable wages, and treat him well, and there can be no possible desire for desertion.

We should have thought that the late disheartening results of the Arctic expeditions that have been sent out during the last few years, would have dissuaded others from risking their lives and their property in similar expeditions where there is apparently so little advantage or information that could ultimately be obtained. It is most probably a physical impossibility that any mercantile traffic can be developed round the Northern coast of Asia, however many times an exploring vessel may succeed in making the passage. The very large proportion of those vessels which come to grief on that ice-bound and iron-bound coast, would represent far too great a percentage of risk to ever allow a successful maritime traffic. We see, however, that a Danish Arctic exploring expedition has, however, just started from Copenhagen. The vessel is called the *Dijmphma*, a most unpronounceable combination of consonants, and she is commanded by Naval Lieutenant Hovgaard. If half the energy and money had been expended on discovery in Africa or elsewhere, where satisfactory commercial and civilizing results might have been obtained, as has been expended in Arctic research, the ral trade would have been much the better.

It may not generally be known that the *Hecla* of her Majesty's Navy, at present in use in the Egyptian expedition, is a converted Atlantic commercial liner. She was bought in 1878 as an experiment by the Government as to the probable value of our commercial marine in case of war. She was armed with five 64-pounders, and one 40-pounder, and has been considered a very useful addition to the Navy. Heavier guns than these were placed by the Russian Government on the cruisers bought by them from the mercantile marine in 1878. And the Chilians armed an Irish cattle boat with an 8-inch 11 ton-gun, and employed it in the bombardment of the Peruvian ports. As many of our best merchant liners have coal storage sufficient to permit a cruise at 10 knots an hour round the world they would be invaluable for the protection of our commerce in foreig seas. Coal-bunkers also, if of sufficient thickness, are most efficient protection against shot and shell. Som very interesting tests have been made by the Government upon the point. A target has been constructed in imitation of the coal-bunkers of a mercantile steamer, and it has been found that the thickness usually provided in steamers of an ordinary beam will suffice to stop shells from the heaviest guns of unarmoured war vessels. If light armour were added such as the vessel could easily carry, the plates and coal bunkers together would prove a most efficient protection even against the 6 and 8 inch Armstrong breechloaders.

A great deal of fuss is now being made about the increased steering powers of modern steamers when operated by steam steering gear. No doubt a very great increase of promptitude in the putting over of the helm has been obtained by steam or other power gear, but w think that an increase of rudder area would be now t proper complement to the increased power of moveme The worst of such an alteration would be the additi strain thrown upon the rudder post from the additi area and leverage of the rudder. We have noticed accidents to rudder-posts are by no means n present, so that it is evident that no increase of p on rudder area can be advocated except for new that can be built of suitable strength. Of co application of twin screws is a most efficien rapid and prompt steering, and we should lik this principle generally applied to all merchant The number of collisions on the high seas doe by any means to be decreasing, so that there be desired in prompt answering to the he screws also offer the further security that i should foul or fail, the vessel is not disabled but has the other screw to fall back upon.

ELECTRICITY AND ITS MODERN DEVELOPMENTS, WITH SPECIAL REFERENCE TO MARINE ENGINEERING.

THE practical developments of electricity have within the last few years—we might almost say the last few months—been sufficiently startling, charming the scientific, and puzzling the ignorant; while from their far-reaching applications commanding the interest and inquiry of all. There is, perhaps, no branch of science which should so readily induce inquirers to devote some time and trouble to mastering its principles; while few studies will so well repay the expenditure, and require so little previous knowledge. So rapid, however, is the progress of development, that few can expect to keep pace with it without special application. The latest manuals are out of date almost ere they leave the printing press, and the contents of the most complete afford but little help to the general reader towards unravelling the newest inventions. Many of these possess phases of great interest to marine engineers, harbour authorities, and sea-faring men. The employment of the arc electric light in naval warfare, for ships' lights, and for the illumination of docks and beacons; the incandescent lamp for use between decks; the electrical firing of torpedoes and submarine mines, electric telegraphy between all parts of a vessel, electric steering apparatus, &c., &c., are branches of this great subject, to which we intend devoting a few articles, we trust with interest and profit to our readers.

It would not be in keeping with our design, even could we spare the space, to give any detailed description of electricity and electrical apparatus in general; but memories that have forgotten, and memories that have perchance never remembered, may be glad to be refreshed by a brief *resumé* of the facts on which the modern science of magneto-dynamics is based.

Dynamical electricity is commonly called *current* electricity, and is sufficiently well represented by the concrete idea of a current flowing along a wire as a liquid flows along a pipe. The wire (using wire as synonymous with conductor) conveying this current is found to possess many remarkable properties, thermal, chemical, physiological, &c., in all of which work is performed. In other words, we find a *difference of potential* between the two ends of the wire. This difference must be produced by some work done between the ends of the wire exterior to the circuit; or, one energy is by the medium of the wire transformed into another energy. Thus, just as a certain quantity of coal burned in a retort will produce a gas jet of a certain brilliance, so will a certain quantity of gas consumed in a gas engine produce an electric arc of corresponding strength or decompose a definite quantity of metal in a bath.

The cell or battery is the earliest and simplest mode of producing a current, and is too well known to require description. Numberless varieties of cells have been invented and combined into batteries in all sorts of ways; but the fundamental fact remains: a current, the type and laws of which never vary, flows from one terminal, called the positive pole, to the other terminal, called the negative pole. The difference between the potential at the + pole and the potential at the — pole is the *electro-motive force* (E) of the current. It may be likened to the head of water. The *quantity* (Q) of the current corresponds to the volume of liquid flowing through a pipe. Just as the pipe opposes by friction the passage of the liquid, so all conductors more or less tend to retard the electric current. This is the *resistance* (R). In a wire, *e.g.*, R varies directly as the length and inversely as the section. By far the best conductors are silver and copper, whose conductivities are nearly equal. From economical reasons copper is universally employed. It is important to note that a rise of temperature diminishes the conductivity and consequently increases the resistance. Assuming proper units of mass, time, and length, *Ohm* found these remarkable laws to hold:—

$$E = Q\,R, \quad Q = \frac{E}{R}, \quad R = \frac{E}{Q}.$$

Here R includes the resistances of the various parts, and is equal to the sum of such resistances. Thus if r be the external or wire resistance, and r^1 the internal or battery resistance, $R = r + r^1$. Hence $E = Q\,r + Q\,r^1$; and if the battery resistance be large, the effective portion of E available for outside work is correspondingly lessened. Again, taking the equation $E = Q\,R$, it is seen we may have either a current of large volume and low resistance, or a current of small quantity and high resistance. The type of the former is a short, thick wire, of the latter a long, fine wire, each class of current having its special applications. In accordance with the general rule for the transformation of energy, the work done $(W) = E\,Q$. Hence $W = Q^2\,R$, and for a typical resistance varies directly as Q^2. In practice the Unit of E is called the *Volt*. Thus the E of a Latimer Clark's Standard cell at $15^\circ.5$ C is 1·457 *Volt*. The unit of R is the *Ohm*, or B A Unit; so called from the length and composition of the standard resistance wire having been decided by a Committee of the British Association. The Unit of Q is called the *Weber*. The *Weber*, by the formula $Q = \frac{E}{R}$ is the current due to one *Volt* working through a resistance of one *Ohm*.* These terms are of constant employment in all accounts of Electrical laws and apparatus, being to the science what such names as horse-power, foot pounds, &c., are to steam.

The discovery that a wire conveying the current,—or as we shall for shortness call it simply the current—deflects a magnetic needle (such as we see in the mariner's compass) in its proximity, opened up a new era. The rule of this deflection may be easily remembered thus. Imagine the observer swimming *with* the current, and his face towards the needle, the N. Pole will be deflected *to the left*. The neutral position is when the needle is at right angles to the current. This law is universal, and holds good when the wire is carried in several convolutions, as on a bobbin or ring, round the needle. The best known example of this is the needle of an ordinary needle-telegraph, long the only practical device for transmitting messages; the current conducted by suitable mechanism alternately in one direction or the other, deflecting the needle to the left or right. The deflections of the needle also furnish a very convenient mode of estimating the strength of currents and the resistance of conductors, and many apparatus have been constructed for this purpose called *Galvanometers*. Subsequent observations showed that a large magnet acted on a freely suspended current, in the same way as the current previously acted on the needle; that the suspended current set itself at right angles to the magnetic meridian; that parallel or converging currents, if flowing in the same direction, attract each other, if in opposite directions repel each other; and finally that if the wire be formed into a spiral or helix, so that there will be a series of circular currents in the same direction, these helices, or *solenoids* as they are called, act towards magnets, towards the earth, and towards each other, exactly as if each were a magnet, possessing poles and all its other peculiarities. These facts led to the conclusion—accepted as established for purposes of explanation and investigation—that the magnetic force is *equivalent* to the effect of currents circulating round the magnet, just as if a wire were wound round it. If the N. Pole of a magnet be held with the end towards the observer, the current circulates in the contrary direction to the hands of a watch. Though circulating in the same direction round the magnet, the current looked at from the S. Pole will obviously appear to go with the watch hand. This will be found to be comprehended in the more general law enunciated above as to swimming with the current.

Further, if an insulated wire be wound round a bar of soft iron, or even two pieces of iron connected by a crosspiece, taking care that the windings are in the same direction from start to finish, and a current be passed through the wire, the soft iron is instantly changed into a magnet. On interrupting the current the magnetisation ceases. These temporary or electro magnets will thus alternately attract and release another piece of iron, or *armature* as it is called. Such an armature is frequently placed so as in its normal position to form part of the path of the current, and in this form can be made automatically to break and remake the current. Such an arrangement enters into almost every electrical apparatus, and may be compared for usefulness to the eccentric or the governor in machinery. A common instance will be found in the various receivers now in use in most Telegraph Offices for recording the message on strips of paper, or in the ordinary shockcoil, wherein the humming sound is caused by the rapid vibration of the armature.

The last great discovery was made by Faraday just fifty years ago. This was *induction* or the production of currents in conductors by the influence of neighbouring currents (including magnets, which are presumed to be solenoids). All the cases are comprehended in the rule following: when a current begins to flow, receives a sudden increase, or is suddenly brought near a neighbouring conductor it induces a momentary *inverse* current in the neighbouring conductor; when a current ceases, is suddenly decreased, or is suddenly removed from a neighbouring conductor, it induces a momentary *direct* current in the neighbouring conductor. In the following form, which will be found on examination to correspond to the above, the rule is known as *Lens'* Law. The currents induced by the relative movement of two circuits are always in such directions as to produce mechanical forces tending to oppose the movement. As an example we take a coil or bobbin of insulated wire, in the centre of the spool we place a bar of soft iron or *core*, we now bring near a permanent magnet. The latter induces currents in the iron core forming it into a temporary magnet. This sudden magnetisation produces a current in the coil. On removing the permanent magnet the iron core is demagnetised and a current in a direction contrary to the first is produced.

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* We may mention that the *Volt* = 10^8 C. G. S. Absolute Units.
the *Ohm* = 10^9 C. G. S. ,, ,,
and consequently the *Weber* = $\frac{1}{10}$ C. G. S. ,, ,,

This discovery was soon applied practically. The substantial principle was to cause parallel coils joined in the fashion of an electro magnet, to rotate before the poles of a large permanent magnet, the momentary currents being produced so rapidly as to form practically a continuous one, and if necessary (as in electro plating) the currents in opposite directions were by suitable commutators diverted to one direction in the wire. It was subsequently found that soft iron, once magnetised, retained a certain amount of permanent magnetism and a further development took place. The permanent magnets were replaced by electro magnets, the wires of which were connected to the revolving coils or *armature*. The soft iron produced feeble currents in the armature, these currents passing through the fixed coils further increased the magnetisation of their soft iron cores, this reacted on the armature, and this reciprocal action took place until most powerful currents were attained. All modern machines are substantially developments of this principle, to be seen in one of its highest manifestations in the Brush Dynamo, which in conjunction with the light we have selected to describe and illustrate.

The calculation of forces naturally becomes complicated in these elaborate machines, but the general laws are simple enough. The sphere of action of the fixed magnet is called the Magnetic Field. In this field the force acts in definite lines, called *lines of force*. These may be + or − and their sum is to be considered their algebraical sum. The electro motive force of the current generated in the armature moving in the magnetic field varies directly as the intensity of the field, or as the number of lines of force cut through in unit time. It also varies directly as the velocity through the field, *i.e.*, as the speed of rotation. To produce high E the armatures should thus be rotated with great rapidity in as close proximity as possible to the poles of powerful field magnets.

The number of dynamo machines, most presenting some useful and interesting distinguishing feature, is so large that it would be impossible here even to enumerate them; we have therefore selected the Brush as a concrete, well-known and undeniably successful specimen of the class. We have purposely avoided pointing out wherein it varies from its competitors, and have even omitted many minor details peculiar to itself; our aim solely being to give such a general description as shall enable engineers and others who have made no special study of the subject, to understand the more technical descriptions of any machine which may be brought under their notice.

Fig. 1 shows very clearly the general structure and appearance of the machine. In the centre, the ring with semi-cylindrical projections is the *armature*, the shaft of which, running in long bearings, is seen to carry on the extreme left the driving pulley, on the extreme right the *commutator*, an arrangement for conveying away the currents of electricity. The large coils on each side of the ring are two of the fixed or *field* electro-magnets. Of these there are four, the others being parallel to and behind those seen in the engraving. These are so wound and connected that each pair on the same side of the ring forms a horse-shoe magnet, while the opposite pairs have the same polarity. That is, the two field magnets in the front of the engraving are both S, or both N poles, the pair behind being, *vice versâ*, both N or both S. These poles are, it will be seen, not circular bobbins, but are expanded upwards and downwards into a long oval, embracing closely over one-third of the armature ring on each side, leaving a section of about one sixth, at the top and bottom of the ring, out of the magnetic field or influence. The armature itself is no longer the elementary coil or bobbin of the early experimenters, it has developed into a highly complicated arrangement. It consists of a cast iron ring, forming the core on which are wound eight separate bobbins. A reference to Fig. 2 will explain more clearly than any verbal description its peculiar construction. The various grooves cut in this ring serve a double purpose. They prevent cross currents and consequent points being formed in the ring, and they allow free ventilation. The latter point is a most important one, the tendency being to the production of heat, which increases the resistance and produces deterioration of the component parts of the apparatus. Let us consider separately one bobbin. This bobbin is a multiple solenoid, and with its core may be looked upon as an elementary magnet. Starting from the lowest point of the ring it enters the magnetic field, the most powerful point of which will be when the coil reaches the radially horizontal position. In approaching this point, assuming that the field magnet polarity is N, and applying Lenz law, the bobbin becomes a magnet of which the upper end is the N pole, the lower end the S pole. Receding from this position, the influence of the magnetic field is reversed, but the position of the coil is also reversed, thus (as two negatives give a positive), the absolute magnetic condition of the bobbin is retained, its strength gradually diminishing until the top or highest position is reached. Thus between the two neutral points—top and bottom—a current is induced in the wire in one definite direction, the maximum strength of which is when the centre of the poles of the field magnets is reached. A similar investigation will show that as the bobbin proceeds on its course, and, in reaching its initial position, passes between the S poles of the field magnet, a current is produced in the reverse direction. Now, in the Brush ring, the bobbins as shown are connected in pairs, each two diametrically opposite sections being coupled up together, the inner ends of the wires being so crossed that the direct and inverse currents flow in one and the same direction through the wire. Of the two external ends one is thus, a + ve pole, the other a — ve pole, during one half of the revolution, while during the other half the polarities are reversed. From these four pairs of poles the electricity generated by the revolution is carried away, and the ring may be compared to two semi-circular magnets with their like poles joined.

Fig. 3 shows on a larger scale the commutator, which is seen on the extreme right of the shaft in Fig. 1. The commutator bears a ring for each pair of coils on the armature, such ring consisting of two pieces of metal, of the form shown below the figure, fixed on but insulated from the shaft and revolving with it. The free ends of the wires from the bobbins are carried through the shaft and attached pair by pair to diametrically opposite sections of a corresponding ring. Each ring thus presents a + ve and a — ve pole, the polarity changing, *i.e.*, the currents through the wire reversing twice in each revolution. For an armature wound with eight bobbins there are therefore four rings, each furnishing a current and presenting in all four + ve and four — ve poles. The electric currents are collected from these poles by two pairs of diametrically opposed metal combs, or brushes as they are technically called. Each brush is mounted on an adjustable spring, its breadth embraces two adjoining rings, and the arrangement is such that there are always two + ve and two — ve brushes. From one pair of brushes, the circuit is completed by the thick wire wound in one continuous length round the four field magnets. From the other pair, the circuit is completed through the lamps or other apparatus in the path of the current. Though the word current for convenience be employed, it will be seen that the phenomenon really taking place is a series of pulsations or throbs, two of which occur in each revolution. Thus with a machine revolving at its normal speed of 750 revolutions per minute, there are 1500 pulsations per minute.

Before proceeding to describe the lamps, it may be interesting to quote, without detailing the method of measurement, the result of a series of severe and accurate measurements made by several well known American engineers.

The machine was of the size known as No. 7, driven by a Buckeye engine, and lighting sixteen lamps of the usual pattern with 200 feet of copper line wire, No. 10.

Speed of engine	157	Revolutions per minute.
Average speed of machine	770	,, ,,
Total driving power required	15.48	H.P.
Driving power absorbed in production of current	13.78	H.P.
Resistance of dymano machine	10.55	Ohms.
,, external circuit	72.96	,,
Total Resistance	83.51	,,
Electromotive force of current	839.02	Volts.
Volume by $Q = \frac{E}{R}$	10.04	Webers.
Energy of current*	11.285	H.P.
Percentage of gross power converted into current	72.90	
,, absorbed ,, ,,	81.89	
,, gross power appearing in arcs	61.24	
,, absorbed ,, ,,	68.79	

In the Brush system the electric current is conducted to the lamps by a single wire, and the main current passes in succession through each arc lamp. We cannot here pause to discuss the much vexed and disputed questions of the advantages or disadvan-

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[*] This is deduced from the formula W=value in foot-pound=$C^2 R t \times$ ·737335, where t is seconds, and ·737335 is the numerical equivalent of our unit, *i.e.*, the foot-pounds of oneweber per ohm per second. Thus we have $W=(10.04)^2 \times 83{\cdot}51 \times 60'' \times {\cdot}737335=37241{\cdot}58$; whence dividing by 33,000, we get 11·285 horse-power as above.

tages of connecting the lamps thus in series or in parallel circuit, or the difficulties attending the sub-division of the current; suffice it to remark that much can be said on every side of the problem, and to hope that our readers will now be able to appreciate for themselves the force of the arguments laid before them by advocates of rival systems.

Electric Lights fall into three classes. (1) The Incandescent, such as the Edison, Swan, Lane-Fox, and Maxim. The principle of these is identical. Some substance introduced into the circuit increases the resistance at that point to such an extent that the accompanying increased production of heat raises the interposed conductor to a state of incandescence, thus throwing off light. The problem is to find a conductor which will not speedily be consumed or burned away in the process. In some that most refractory metal platinum is employed, in others, while a filament of carbon is used, the incandescent portion is enclosed in a vacuum. In other words, the abstraction of oxygen prevents the consumption or burning of the incandescent conductor. There are no moving parts in these lamps, and the difficulties are those of accurate construction and suitable materials.

2. The Semi-Incandescent, such as the Joel, Werderman, Jablockhoff, and the "Lampe Soleil." Here two conductors or a conductor and a refractory material, such as marble, are kept by mechanical or others means in contact, the waste being allowed to take place at such point of contact. The devices for effecting the desired object are often similar to those used in the third class, although in some great simplicity is admissible, even at the risk of attendant disadvantages.

3. The Arc light, such as the Brush, Crompton Weston, Gulcher, Pilsen, Gerard, &c. The principle of all these is the same: two pointed rods of carbon are interposed in the path of the current, the points being in contact. On closing the circuit the points become heated, on gradually separating them a luminous arc is formed, its length and brightness depending on the strength of the current, size of carbons, &c. This arc derives its luminosity in part from the glow of the incandescent carbon points, in part from the actual passage of incandescent particles of carbon between the points. As this process goes on the carbons are consumed, the distance between the points increases, the resistance correspondingly increases, the light correspondingly diminishes, and finally goes out. We therefore can thus state the problem to be solved On completing the circuit the carbons must be separated to the suitable distance for forming the arc, and must be maintained at that distance. On the success with which this is done depends the regularity and steadiness of the light.

As will readily be conjectured, an enormous number of devices have been suggested in the view of attaining this object. The most successful are those wherein the electrical current is itself employed as the regulator. Simplicity of mechanism and certainty of action are thereby ensured, and, theoretically, perfect steadiness should result. The Brush lamp is of this type, and its action will be understood from the diagram, Fig. 6. The diagram does not represent the actual position of the parts in the lamp-casing, but exhibits them distinct and separate, so that the paths of the electric currents may be traced. K^1 is the lower carbon rod, the holder of which is fixed. K is the upper carbon, the holder of which is carried by an ingenious little washer or clutch W. The latter is shown on an enlarged scale in Fig. 5; and it will be easily seen how if the arm V be caused to rise or fall, K will be either bodily lifted up or allowed to slide down through the opening in W. V is attached to $C C^1$, two soft iron plungers or cores moving freely in the bobbins $S S^1$. The electric current entering at P is conveyed by thick wires round the bobbins $S S^1$, thence to the upper carbon holder, through the touching points $K K^1$ to the lower carbon holder, and finally quits the lamp at N. Another path is provided for it through R and E, but it can only pass in this direction when contact is made between B and B^1. Diverging from the main track of the current is a fine wire, represented by the dotted line in the figure. This wire is carried round $S S^1$ in the opposite direction to the thick wire, and further is wound round E in the same direction as the thick wire. This branch or shunt wire, being very fine and consequently of high resistance, only takes about 1 per cent. of the current; but being wound many times round the bobbins produces considerable effect. It is so regulated as nearly to balance the coils of thick wire when in the normal condition. On the current being allowed to pass through the lamp the effect of the bobbins $S S^1$ is to attract or suck in the plunger $C C^1$, thus raising K and forming the arc. The wires on the bobbins are so arranged as to produce the most effective length and to maintain the same. For if the arc lengthens, the resistance in the main path of the current is increased, and in consequence, a greater proportion of the current is diverted through the fine shunt wire. Thus the opposing forces of the thick and thin wires become more nearly equal, the resultant attraction on $C C^1$ is diminished; the latter consequently drop, releasing K, which falls until the equilibrium is again established. This process goes on until the carbons are consumed. The action is not, as might be imagined from the description, a series of jerks, but a perfectly regular and steady motion, maintaining an arc of uniform length and brilliance. Should any accident happen, such as a carbon breaking, falling out, or being consumed, the current in the fine wire will become so strong that the core of E will be able to attract A in spite of the resistance of the spring R. Contact will thus be made between B and B^1, and to this channel the main current will be diverted, cutting the lamp out of the circuit. Fig. 4 shows one of the ordinary forms of the lamp as used, the bobbins and other apparatus being contained in the case at the top.

To be continued.

ARTILLERY OPERATIONS OF SHIPS AND FORTS BEFORE ALEXANDRIA.

SINCE the Crimean War, and especially during the last five years, consequent upon the construction of strong armour-plated war ships, the manufacture of enormous guns, the use of rifled instead of smooth-bored ordnance, elongated explosive chilled projectiles in the place of spherical shot, and the extensive employment of breech in substitution of muzzle loading; not to mention torpedo boats, and Gatling and Nordenfeldt Machine guns; prodigious changes have been effected for destruction and protection in naval warfare, but they have never been put to a scientific test upon a large scale, previous to the bombardment of the forts of Alexandria.

Now the lesson of this engagement is, and will be, very much discussed for a long time by naval and military men, and scientific engineers, as well as by the press, and the general public at home and abroad. Unfortunately, we have but very vague reports concerning the destruction of our guns, and the damage to our ships in the cannonade; nevertheless, the published accounts of such by newspaper correspondents and others, and the comments on them by the press furnish us in the aggregate with some appreciable facts and important results which are well worthy of reflection, pending the official enquiry directed to be made by the Admiralty on the effect of the enemy's fire upon the armour of each of our ships.

The ironclads that were engaged in the bombardment were the *Invincible*, *Penelope*, and *Monarch*, assisted by the *Téméraire* against Forts Meks, its batteries, and Marsa-el-Kanat, while the *Superb*, *Alexandra*, and *Sultan*, aided by the *Inflexible* combatted Forts Pharos, Ras-el-Tin, the Hospital Battery, and Ada. These eight ships mounted four 81-ton guns, in addition to smaller pieces and machine guns- The ships were clad with armour plate, which varied from 6 to 24 inches in thickness. The Alexandria forts were thought to contain eight 18-ton guns, and many lighter pieces, but most of them were smooth-bores, casting round balls which could not pierce the plating of our ships.

The cannonade began at 7 o'clock in the morning, and did not cease until 4 o'clock in the afternoon, when all the outer and principal forts were silenced. But those of Ras-el-Tin and Ada were not subdued without the help of the *Inflexible* and *Téméraire*. The firing from the British Artillery after the first round was said to be very defective, and almost hap-hazard, as the light wind was insufficient to carry off the smoke. According to the *Army and Navy Gazette* "it is not too much to say that had the smoke permitted rapid firing and more accurate aim, the fate of Alexandria would all have been *hors-de-combat* in an hour." With regard to the merit of independent and broadside firing for giving the greatest number of hits in a certain time, we are informed by the *Times* that "all other things being equal, it may be accepted as a rule that so long as smoke does not interfere, the number of hits will increase with the number of guns, but when the smoke does not clear away . . . . independent firing becomes less effective than volleys at short ranges, and for the reason that while less accurate, a greater number of shots can be fired by the latter system with a fair amount of precision." The *Official Manual*, however, observes that these matters "can only be finally decided by actual war, but great caution must be exercised against drawing hasty conclusions from an isolated action." Scarcely any experiments have been made to approximately determine the probability of hitting a particular object with existing rifled ordnance, when average projectiles are fired at known distances from a rolling or heaving ship or platform in motion. The late bombardment will probably assist to a great extent to solve this problem, and the difficulty of accurate aiming when the bearings and distances change.

Nearly all the artillery used in this cannonade consisting of guns of different marks, calibres, and rifling, belong to a condemned ordnance for naval purposes, and which is being gradually superseded As, however, no authentic account has been given as to the cause of the reported splitting of two of the *Alexandra's* guns on the bombardment, various explanations have been offered, but the better opinion appears to be that this injury was owing to the deep grooves and the use of studs instead of gas checks in the guns. The two ships which rendered by far the best service in the fleet against the forts were the *Inflexible* and *Tèméraire*. The immense range of their turret and barbette guns enabled them to begin firing at from 3,000 to 5,000 yards from the forts being outside the radius of the heavy ordnance of the enemy's shot. The mounting of the heavy guns of the *Inflexible* within rotating turrets, and of the *Téméraire* upon revolving platforms permitted them to be fired ahead or abeam without altering position. Forts Ada and Pharos appeared to have suffered but little damage from the continued attacks of the *Alexandra*, *Superb* and *Sultan*, and notwithstanding they fired upon them as near as 800 yards, these forts continued their fire, and they were not silenced until they were shot at by the guns of the *Inflexible* and *Téméraire*. Commenting upon the superiority of these two ships the *Times* well observes that "there was no jamming of the turrets or turn-tables; the hydraulic machinery which is used in both ships to load, elevate, and train the guns seems to have worked without a hitch, while the various automatic arrangements would appear to have answered all the demands made upon them. . . . The *Inflexible* was the first ship in which turrets were arranged *én echelon*, so that the whole of her armament could be fired on the line of the keel. She was the first ship in which Mr. Rendel's hydraulic system was thoroughly applied, not only to work her four guns, but to rotate the turrets themselves, which it does with the regularity of a watch. The *Inflexible* was also the first ship to which the protection of compound armour was given. But while she may thus be said to embody a combination of novelties, the feature which more particularly distinguishes her from most other ships is the nature of her armament. She was the first, and she promises to be the last ship to carry 80-ton guns. This colossal ordnance which is worked with the greatest of ease, measures 26 feet 9 inches in length, has a calibre of 16 inches, and fires a projectile of the enormous weight of 1,700 lb. With a charge of 370 pound of cubical powder, it was found capable of penetrating 22 inches of iron at 1,000 yards while at a range equal to that at which the *Inflexible* engaged Fort Pharos, the mean error in direction was 1 8 yards, while the error in range was under 15 yards. The charges, however, have been greatly increased since the experimental stage without straining the gun, and with a material augmentation of velocity and penetrating energy. The *Téméraire* is in every respect a less formidable engine of war than the *Inflexible*. Her heavy guns, however, are capable of penetrating 13.35 inches of iron at 1,000 yards; a power which would enable her to pierce the side protection of every ship in the service with the exception of a few which may be readily counted on the fingers. The *Téméraire*, however, has the merit of combining the advantages of a central battery ship of the *Alexandra* type, with some of the advantages of the turret class, inasmuch as she carries an upper-deck battery in two fixed towers. The guns are fitted upon bell levers, and disappear to the loading position after firing, utilizing the recoil after the Moncrieff method."

The Egyptian artillerists, contrary to expectation, stood well to their guns, and struck our ships many times, but without inflicting any serious damage to them, consequent upon the very inferior kind of ordnance and projectiles they used, mostly consisting of smooth-bored guns and round shot. None of the conical projectiles, says the *Saturday Review*, which the enemy is said to have fired from their few rifled cannon, appear to have hit any ship. The most dangerous shots which they received were from solid nine-inch round balls; but even these were capable of destroying our gun boats, and doing much damage to the weaker armour-plated ships and of causing serious loss and injury to their crews by striking and splintering the unarmed parts, although the shots did not pierce any of the plates which protected these ships.

The *Army and Navy Gazette*, however, properly states "that according to the calculated force and resistance of guns and armour-plates respectively, the nine-inch rifle guns of the forts ought to have been capable of piercing the armour of all the ships engaged, with the exception of the *Inflexible* . . . The results will surprise the theorists, but it is only what real practical men have long ago urged. They maintained that the official trials were, in fact, no trials at all of the practical power of the resistance of plates to penetration. They were placed at an exact right angle to the guns, whereas in action shots would almost never strike at a right angle, and they were fixed rigidly and backed so solidly as to prevent the slightest give. In practice the give will be considerable. The vessel will boldly yield to the strokes of a very heavy shot, and the framework will also yield somewhat to the stroke. The difference in effect is as great as that of a blow delivered by a fist against the head of a man placed in contact with a wall, and a blow given when the recipient's head can be driven back by the blow. Most men would rather receive four blows under the latter circumstances than one under the former."

With regard to the injuries sustained by armour-plated ships, the *Sultan* has had several shots through her unarmed parts and the funnel and mainmast. The *Invincible*, which was struck many times, had her fore-royal braces shot away. Four of the guns of the Fort Meks, which were all placed under cover, and had not been silenced for four hours after the commencement of the bombardment, were for a considerable time concentrated upon this ship, which was plated with eight inches of armour at the water-line, and six inches over the greater part of her side, and the shots struck every time. The *Superb* appears to have received the worst damage. Her funnel was pierced, and a plate below her foremast glacis was torn away.

It is evident that even the thinnest armour plating of the ships was valuable, and saved many lives and much damage to the machinery and appliances for warfare. The lessons of the bombardment of the Forts which have an important bearing upon naval warfare are, says *Engineering*, "The great protective value of armour-plating to life, and to the machinery, and fighting power of a ship, the necessity of making the heaviest guns the primary offensive weapons, and the difficulty of fighting with precision, and maintaining a watchful defence against small craft through the smoke of an action." We are further of opinion that gas-checks and breech-loading ordnance and turret ships should be more employed than they have been in the Navy. The only great advocate for unarmoured or "freely penetrable ships" is Sir William Armstrong, who advocated them in his inaugural address as President of the Institute of Civil Engineers, in January last; but his arguments in their favour have been refuted by many eminent authorities upon the construction of warships, and particularly by Mr. Samuda in a recent paper read by him before the Institute of Naval Architects. The importance of armour-coated vessels for the Navy is further evidenced by the report of the committee appointed by the Admiralty in 1878 to examine the *Inflexible*, which states that "targets representing a ship's side, carrying 22 inches of armour, both in one plate, and in double plates, have been completely permeated by shell from existing guns, with a surplus of energy sufficient to enable the same effect to be produced at a range of 2000 yards. Such guns, if exceptional now, will not long remain so. It is thus abundantly clear that an advance at once from the 12-inch armour of the *Devastation* and *Thunderer* class to 24 inches in the *Inflexible* was absolutely necessary if the ship was to be regarded as reasonably fit to encounter even existing artillery. Already that thickness can scarcely be relied on to keep out a single projectile from the heaviest existing guns; it certainly leaves little or no margin for the further growth of guns, or for the effect of blows repeated at or near any one part."

The advantage of a compound armour over armour formed entirely of either steel or iron has been satisfactorily tested by experiments at Shoeburyness and Portsmouth. Compound armour has been used for the turrets of the *Inflexible* and those of the new ships *Ajax* and *Agamemnon*. It has also been decided to apply this armour to the sides of war-ships. Several of the largest armour-plated ships which are being constructed in the French dockyards, will be clad with the Wilson compound armour similar to that supplied to the English Navy. The late Mr. John Scott Russell, Vice-President of the Institute of Naval Architects, strongly recommended the use of these compound plates both for batteries and ships, in a paper he read on this subject before this body. He also recommended that those ships which required and could carry thicker armour than they then had, should be overlaid by a new coating of steel, an experiment which would be very serviceable to some existing ships, while its cost in time and money would be much less than that of recoating them with entirely new armour. We are informed by *Engineering* that "Steel-faced armour of similar thickness with iron, will afford one-third to one-fourth more resistance, while the superior tenacity and ductility of the material will give it a further important advantage in resisting disruption, and thus in most cases restrict the damage that would result both to the ship struck and the crew inside it, while the same characteristic exists as to the ductility and superior qualities of the steel hull, and the additional strength it possesses enables the naval architect to reduce the weight of his ship, and to improve his lines without diminishing the strength of the fabric."

An important lecture appears in the Minutes of the Proceedings of the Artillery Institution upon "Armoured Defences," which was delivered by Colonel Inglis, R.E., in which he says that "all the most successful compound plates have been made of ordinary armour-plate iron, faced with Bessemer steel," and while admitting that as good or a better face might be given by the use of crucible steel, the cost and difficulty in the use of the latter would be enormous, and that "but for the Bessemer and Martin-Siemen's processes, it would have been practically out of the question to make compound plates at all."

While there has been controversy respecting the merits of breech and muzzle-loading artillery for naval warfare, the evidence is greatly in favour of the adoption of the former, as it requires less labour to work than the latter of the same size, and cannot be double-loaded as a 38-ton muzzle loader in the *Thunderer* was when it burst in the fore turret of that ship, and caused a dreadful accident. Other advantages of breech loaders is that they require no sponging out, and can be loaded in any position, while they and their crew are much better protected against the fire of shrapnel, machine guns, and rifles. Heavier ordnance as Krupp's 70-ton-guns can also be efficiently worked by hand alone in breech-loading.

The use of gas-checks appears to be of very great importance in artillery operations; and the *Times*, which is of opinion that the accident to the two guns of the *Alexandra* was owing to the absence of these appliances, offers an appreciable notification concerning them by stating that "without gas-checks the 18-ton gun with a charge of 70 lbs. of P powder gives to a chilled projectile, weighing 400 lbs., a muzzle velocity of 1,364 ft. per second, and an energy of 5,160 foot-tons, while with gas-checks, under the same conditions, the velocity is increased to 1,433 ft., and the energy to 5,810 foot-tons . . . But it is only very lately that the gas-check has displaced the use of studs as a means of rotation. The principle, however, has been adopted in its entirety in the 80-ton guns of the *Inflexible* with the resulting advantages that the bore is less weakened by a number of shallow than by a few deep grooves; that the projectile is not weakened by stud-holes; and that as the number of grooves is so much greater, the total bearing-surface of the grooves is larger. The rifling of the 80-ton gun consists of 33 grooves, having a width of 1 inch, and a depth of 1-10th of an inch, while the lands or spaces between the grooves are 523 inches wide."

The different kinds of armour-plated ships are generally arranged as broadsides and turreted vessels. The latter, which are of very recent date, have proved to be so superior to the former in naval warfare that several of them have been constructed for the British Government. The only other European nations which have adopted the turret systems besides England, to a considerable extent, are Holland and Italy, and the fighting force of the Dutch Navy appears to entirely consist of turreted ships. Four of those belonging to Italy are mounted with four 100-ton Armstrong guns. On account of experiments made on one of these enormous guns, the central portion of the ships are plated with steel instead of iron. The new Italian armour-plated *Dandolo*, which has recently been turned out of the Royal Naval Arsenal at Spezzia, and which is a sister ship to the *Duilio*, has only one mast without sails fixed between her two turrets, arranged diagonally, and therefore the fire from the four guns can be concentrated fore and aft, which is a very great advantage to its destructive power.

In the foregoing remarks we have endeavoured to communicate within a readable compass what we believe to be the essential facts and statements desirable to be publicly notified concerning the only "fleet-fighting" which has taken place with our present terribly destructive *matériel* for naval warfare.

The Velometer.—We understand that an agreement has been entered into by which all actions pending in relation to Durham's velometers have been ended, and that Mr. Durham has joined the firm of Messrs. Churchill & Co. The business will therefore be carried on in future under the style of Durham, Churchill & Co., at 9, East India Chambers, Leadenhall Street, London.

ON CORROSION IN STEAM BOILERS.

By W. J. Norris.

Table I.—*Oxygen.*

Absolute pressure in pounds per square inch	60	75	90	105	120
Pressure in atmospheres ...	4	5	6	7	8
Temperature of mass, in deg C.	145	153	160	166	172
Volume of gas held in solution in 100 volumes of water ...	10.137	13.627	17.171	19.680	24.372
Temperature of mass Atmospheres of pressure ...	36.25°	30 6°	26.66°	23.71°	21.5°

Table II.—*Nitrogen.*

Absolute pressure in pounds per square inch	60	75	90	105	125
Pressure in atmospheres ...	4	5	6	7	8
Temperature of mass, in deg.C.	145	153	160	166	172
Volume of gas held in solution in 100 volumes of water ...	5.004	7.740	8.493	10.277	11.958
Temperature of mass Atmospheres of pressure	36.25°	30.6°	26.66°	23.71°	21.5°

Table III.—*Atmospheric Air.*

Absolute pressure in pounds per square inch	60	75	90	105	120
Pressures in atmospheres ...	4	5	6	7	8
Temperature of mass, in deg.C.	145	153	160	166	172
Volume of air held in solution in 100 volumes of water ...	6.084	8.178	10.306	12 471	14.707
Relative volume of oxygen ...	2.129	2.955	3.607	4.364	5.147
" " nitrogen ...	3.955	5.123	6.699	8.107	9.560
Temperature of mass Atmospheres of pressure	36.25°	30.6°	26.66°	23.71°	21.5°

It is practically impossible to calculate the volume of carbonic acid that would be held in solution under the above conditions, owing to the quantity of air which passes into the water in boilers and the relative quantity of this gas forming part of the atmosphere; it is doubtless very large, and careful experiments and analyses can alone decide the volume.

These tables show the volumes of gas having a tension equal to one atmosphere of pressure, at which the water becomes saturated under the working pressures and temperatures of steam boilers of the present day, and would be correct if the steam space of the boiler were filled with the particular gas to which they refer—a condition which is, of course, unattainable, as it is filled with a fluid much lighter than air or either of its constituent gases; therefore, the air pumped or forced into the boilers by the feed pumps must be subject to two distinct actions which come into operation, viz.:

1. The attraction the water exerts for each particular gas.
2. The force of gravity.

In absorbing air, water separates and dissolves a volume of gas according to the attractive force it exerts towards each of its constituent gases, the force of which attraction is shown by the "coefficients of absorption," and is equal to

$$\frac{C^o}{C^n} = \frac{.04115}{.02034} = 2.0225$$

or rather more than twice for oxygen than for nitrogen. This is proved by the fact that air expelled from water by boiling is composed as follows:

Oxygen	34.9
Nitrogen	65.09
	99.99

Hence to saturate water with air at the ordinary atmospheric pressure for every 100 volumes in solution $35-21 \times 100=170$ volumes of air must be passed through it, of which 35 volumes of oxygen and 65 volumes of nitrogen are absorbed, the remaining 70 volumes of nitrogen being rejected.

This fact has no important bearing on the subject under consideration. From it, and the two actions just referred to, it follows that the steam and gases forced into the water will rise and leave the water in accordance with their degree of solubility, and specific gravities, which, compared, with air as unity, are as follows :

Spec. grav. of steam .625, nitrogen .927, oxygen 1.11, $C.O^{2}$. 1.527.

These specific gravities hold good for all pressures under Marriott's law that the pressure varies as the volume, and, further, that these gases expand an equal degree for equal increments of temperature.

Thus it would appear that the steam will leave the water first, the nitrogen second, and the oxygen last, and that the excess gases will range themselves in the steam space in layers according to their densities, through which the steam will rise as it does in water.

In the condition shown, these gases have no tendency to rise, except by a slow process of commingling, by which the oxygen is constantly, but slowly, mixing with the nitrogen, and the mixture of oxygen and nitrogen with the steam, the volume so lost being, however, as constantly replaced from the air forced in with the feed water.

If this is so, we come to the absorption of oxygen and carbonic acid alone, and Table No. 1 shows, with more or less exactness, the condition of the water in steam boilers under ordinary working, and water so charged would be ample, if not more than sufficient, to account for the corrosion.

If, however, we take it that no separation of the gases occurs in the boiler, and deal with it as the absorption of atmospheric air, we have, even then, a large volume of oxygen, which, as will be seen from Table III., ranges from four times and upwards the volume of this gas held in solution under the ordinary conditions of the atmosphere, and 0° C of temperature, for the usual working pressures of steam boilers, with an indeterminate volume of carbonic acid, volumes which being, moreover, aided by high temperature, are sufficient to cause rapid corrosion. The probability is that neither Table accurately expresses the condition of the water, but that the volume of oxygen in solution varies in actual practice from the limit of the one to the limit of the other.

Referring again to the drawings, the conditions illustrated may, perhaps, be brought out more clearly by comparing the gases within the boiler to those within a well. In the latter case, as every one knows, carbonic acid gas gravitates to the bottom, and has no tendency to rise, owing to its greater density and weight than the atmosphere, the ratio between the two being as 1 to 1.527. Substituting steam in the boiler for the atmosphere, the cases, excepting of course, the higher pressures and temperatures, are similar, the ratios between the gases and steam being as follows :

Steam to nitrogen	1 to 1.395
„ „ oxygen	1 to 1.776
„ „ air	1 to 1.584

These great differences in the specific gravities are sufficient to prevent the denser gases rising, so that the water is constantly charged with gas to saturation, either oxygen and carbonic acid alone or a mixture of oxygen, nitrogen, and carbonic acid.

This question is undoubtedly worth solving, and is one that, assuming the theory of free oxygen in the water, with properly-constructed appliances, admits of almost easy solution. The expense of same would probably prevent private firms and individuals from taking up this question, as, apart from the cost of the necessary appliances, would be the employment of a chemist competent to deal with it, and make a series of quantitative analyses.

Not being, however, in possession of data derived from experiment in this direction, let us examine what proofs of the theory can be adduced from actual working.

We have seen that the theory of galvanic action, though possible is very improbable, and that the alkaline condition of the water negatives the theory of acidity, but does not the perished zinc from the boiler afford some evidence as to the action that takes place ? On carefully examining this substance it seems to have changed to an oxide, similar to that formed on the surface of the molten metal when exposed to the atmosphere, and if so, both would be subject to the same tests.

The first test would be that each would be fixed in the fire. On subjecting the perished zinc to this test it was found to be thoroughly fixed ; even under the intense heat of a blow-pipe flame it remains unchanged, except that portions of the metal that have not become oxidised melt out, ignite, and burn.

A second test for these oxides is that each would be soluble in hydrochloric acid, and in water acidulated with sulphuric acid. On carrying out these tests both will be found to be dissolved. There is, however, this difference between them, that the oxide from the boiler takes longer to decompose, due probably to the different conditions under which the oxidation was effected, as the oxide formed on the surface of the molten metal is by the oxygen derived from the atmosphere in a rarefied state, due to the heat, while that from the boiler is effected under water and under pressure, at a temperature of about half that of its melting point, and is probably hydrated.

It follows from these tests that the process by which zinc perishes in steam boilers is analogous in many respects to the formation of an oxide scale on the surface of the molten metal exposed to the atmosphere, and the question arises, having a high temperature, whence came the oxygen necessary to transform the metal ? Surely not from any decomposition of the water or of the salts contained therein, for if any took place, the hydrogen set free would combine with the chlorine of the chlorides contained in sea water, on account of its intense affinity for this gas, the water would become strongly acidulated, and the zinc probably dissolved ; but the answer is, we submit, to be found in the theory of absorption, as herein stated.

It may, perhaps, be worth mentioning that a slab of zinc, say 12 in. by 12 in. by 1½ in. thick, is completely oxidised in trips from London to the Mediterranean in about six weeks, while in the home trade similar slabs perish in about eight weeks, under steam about four days per week.

The theory of oxidation by free oxygen in the water provides an answer to the point that the corrosive agent, whatever it may be, must be thoroughly diffused throughout the water, and from the laws herein stated it will be evident that wherever the water is quiescent and coolest, as that portion of the boiler below the fire-bars, and where the circulation is restricted, as amongst the tubes, there the pitting will be greatest, and that it will be least where the heat and circulation are greatest, as on the tops of furnaces and combustion chambers, and such, there is reason to believe, is the general experience.

This paper has dealt more particularly with the extent of the aërification of the water in steam boilers, rather than the process by which pitting ensues therefrom, for an explanation of which we cannot do better than refer to the very able paper by Mr. Mallet, in vol. xiii. of the Transactions of the Institution of Naval Architects, wherein the causes are well explained.

In conclusion, the study of this subject points to the remedy for the evil being to supply the boilers with water free from air or gases in solution, and as oil or grease within a boiler can do no good, they should be kept out ; if this was done, boilers would, doubtless, last very much longer, and be more profitable to their owners.

ANALYSES HEREIN REFERRED TO.

Analyses of Deposit from the Boilers of the s.s. "Carnatic."

Moisture lost at 212 deg.	18.7	18.9
Organic moisture and matter given off above 212 deg.	3.3	3.3
Fat	3.4	3.2
Residue insoluble in hydrochloric acid, sand, &c.	1.36	1.22
Oxide of copper	.42	.35
Peroxide of iron	60.93	60.34
Protoxide of iron	5 55	
Sulphate of iron	.67	
Alumina	2 8	2.8
Sulphate of lime	1.03	
Magnesia	.92	
Chloride of sodium	.93	
	100 01	

(Signed HOFFMAN.

Analyses of Four Samples of Deposit taken from the Boilers of the s.s. "Carnatic."

Mr. G. H. Ogaton to Messrs. Humphreys & Co.

—	Aft Starboard No. 1 Boiler.	Fore Starboard No. 2 Boiler.	ForePort No. 3 Boiler.	Aft Port No. 4 Boiler.
Oxide of iron	42.11	47.0	40.08	40.32
Tallow	10.33	11.18	8.16	8.15
Sulphate of soda...	2.13	2.03	2.0	1.74
Muriate of soda	1.31	1.18	2.13	1.64
Carbonate of lime	10.03	8.24	9.60	7.91
Sulphate of lime...	2.12	3.0	2.18	1.8
Sand and clay	8.99	6.10	13.12	8.23
Water	22.47	21.27	22.	30.0
	9949	100.	99.27	99.79

No trace of copper.

Analysis of a Sample of Boiler from the s.s. "Elder."
Specific gravity, 1.12. Reaction, alkaline.

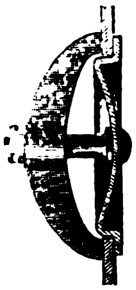
Sodium chloride	20.633
Magnesium chloride	1.8631
Magnesium sulphate	1.1699
Water	76.334
	100.

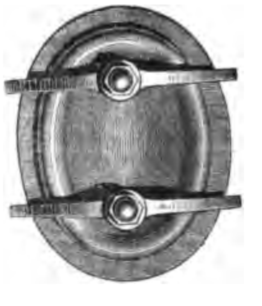
(Signed) PHILLIP HOLLAND, F.C.S.

To P. Moir, Crane & Co.

MAN-HOLE DOORS.

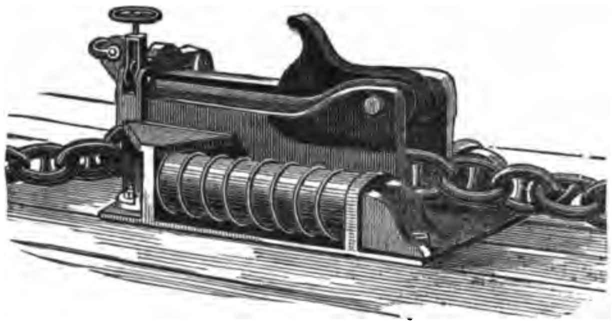
AMONG the many minor improvements daily cropping up and pushing their way into that extended sale which is the reward of merit, we would notice M'Neils patent embossed Man-hole and Sludge Doors, introduced by Mr. J. C. Anderson, 155, Fenchurch Street. They are made of Siemen's steel plates, the quality of which is guaranteed by the test of manufacture, and the great strength thus imparted is combined with a corresponding diminution of weight. In fact they only weigh about one-half the weight of doors of the ordinary construction. The curved shape into which they are pressed gives great rigidity. On one of these doors, 14½ in. by 11 in. by 7-16 in., being tested by hydraulic pressure, it was found that at 300 lbs. pressure it kept its shape; at 500 lbs. it yielded ⅛ in., but recovered its proper form; at 700 lbs. it yielded ⅝ in., and remained permanently only 7-16 in. out. They are no dearer than cast or wrought iron doors, and are used by many of our most prominent Engineers and Boiler-makers.





SAUNDERS' CABLE CONTROLLER.

THE Patent Cable Controller of Mr. R. Saunders, 20, George Yard, Fenchurch Street, is an appliance which we should consider an indispensable item of a ship's furniture. It is perfectly effective for buffing and protecting cables, moorings, tow-ropes, &c., preventing parting under sudden and excessive strains. Full command is maintained alike in getting in and paying out cable, while in riding all strain is taken off the windlass. The arrangement, as shown in our illustration, is extremely simple. Two parallel cheeks form a groove in which the cable runs. Between the cheeks is loosely pivoted a pawl or clutch, which, when allowed to drop, engages in a link and holds the cable securely. Parallel to the grooves, attached to them at one end but bearing at the other against the framework screwed to the deck, are two spiral springs. The strain on the cable pulling forward the cheeks and clutch is taken up by the springs and a perfect elastic buffer is formed. A smaller portable spring is also made on the same principle. The apparatus has been approved and used by the Admiralty; and the Harbour Master of the Port of Calcutta, where 300 are in use on the moorings, reports that they are "of the greatest service in reducing, if not altogether doing away with the sudden jerk which is thrown on the mooring chains when the Bore comes in," and that as regards their durability they are in every respect satisfactory. The same emphatic commendation is given by the Commander of H.M.S. *Himalaya* after an experience of four years in their use,



DIMENSIONS AND PERFORMANCE OF THE HULL AND MACHINERY OF THE UNITED STATES STEAMER "DISPATCH," WITH ANALYSES OF THE POWER DEVELOPED.[*]

By Chief Engineer ISHERWOOD, U.S. Navy.

Continued from page 91.

SPEED.

Speed of the vessel per hour, in geographical miles of 6086 feet	10·75
Slip of the screw, in per centum of its speed ...	15·0914

RATE OF COMBUSTION.

Pounds of anthracite consumed per hour	1550·
Pounds of refuse per hour from the anthracite, in ash, clinker, etc.	310·
Pounds of combustible or gasifiable portion of the anthracite consumed per hour	1240·
Per centum of the anthracite in refuse of ash, clinker, etc.	20·
Pounds of anthracite consumed per hour per square foot of grate surface	15·50
Pounds of anthracite consumed per hour per square foot of heating surface	0·7001
Pounds of combustible consumed per hour per square foot of grate surface	12·40
Pounds of combustible consumed per hour per square foot of heating surface	0.5601

STEAM PRESSURES IN CYLINDERS, PER INDICATOR.

Pressure on pistons in pounds per square inch above zero, at commencement of their stroke ...	55·90
Pressure on pistons in pounds per square inch above zero, at point of cutting off the steam	53·85
Pressure on pistons in pounds per square inch above zero, at end of their stroke	14·23
Mean back pressure against pistons, including cushioning, in pounds per square inch above zero ...	6·63
Mean back pressure against pistons for the portion of their stroke during which the steam was not cushioned, in pounds per square inch above zero	5·90
Back pressure against pistons, in pounds per square inch above zero, at the point where the cushioning of the steam began	5·39
Indicated pressure on the pistons, in pounds per square inch	21·776
Net pressure on the pistons, in pounds per square inch	20·026
Total pressure (exclusive of cushioning) on the pistons, in pounds per square inch, reduced in the ratio of the stroke of the piston to the fraction of the stroke completed when the cushioning began	26·693

HORSES-POWER.

Indicated horses-power developed by the engines ...	402·7950
Net horses-power developed by the engines ...	370·4249
Total horses-power developed by the engines ...	493·7458
Total horses power developed from the expanded steam alone	406·8089

ECONOMIC RESULTS.

Pounds of anthracite consumed per hour per indicated horse-power	3·8481
Pounds of anthracite consumed per hour per net horse-power	4·1844
Pounds of anthracite consumed per hour per total horse-power	3·1393
Pounds of combustible consumed per hour per indicated horse-power	3·0785
Pounds of combustible consumed per hour per net horse-power	3·3475
Pounds of combustible consumed per hour per total horse-power	2·5114

WEIGHT OF STEAM ACCOUNTED FOR BY THE INDICATOR.

Pounds of steam present per hour in the cylinders at the point of cutting off, calculated from the pressure there	5355·6091
Pounds of steam present per hour in the cylinders at the end of the stroke of the pistons, calculated from the pressure there	9149·548·
Pounds of steam condensed per hour in the cylinders to furnish the heat transmuted into the total horses-power developed from the expanded steam alone	1078.8964
Sum of the two immediately preceding quantities ...	10228·4451

DISTRIBUTION OF THE POWER DURING THE ABOVE PERFORMANCE.

The following distribution of the average indicated power developed by the engines during the above performance, is made on the supposition: 1st. That the power required to work the engines *per se*, or unloaded, is what was due to a pressure of 1¼ pounds per square inch of the piston. 2nd. The subtraction of the power, thus calculated, from the indicated power, leaves the net power, of which 7½ per centum is taken for the power absorbed by the friction of the load. 3rd. The power expended in overcoming the resistance of the water to the surface of the screw blades is calculated on the data that each square foot of this surface moving in its helical path, with a velocity of 10 feet per second experiences a resistance of 0·45 pound, which resistance for other speeds varies as the square of the speed. 4th. Deducting the sum of the powers absorbed by the friction of the load and expended in overcoming the resistance of the water to the surface of the screw blades, from the net power, leaves a remainder which is expended in the slip of the screw and in the propulsion of the hull. Dividing this remainder in the proportion of the speed of the slip and the speed of the vessel, there is obtained for each the power expended on it.

	H.-Power.		Per Centum of the Net H.-power
Indicated power developed by the engines,	402·7950		
Power expended in working the engines, *per se*	32·3701		
Net power applied to the crankpins ...	370·4249	or	100·0000
Power absorbed by the friction of the load	27·7819	„	7·5000
Power expended in overcoming the resistance of the water to the surface of the screw blades	25·6238	„	6·9147
Power expended in the slip of the screw, ...	47·8426	„	12·9156
Power expended in the propulsion of the vessel	269·1766	„	72·6670
Totals	370·4242		100·0000

A NEW LINE OF STEAMERS FOR THE ATLANTIC.—It is reported that a Swedish Engineer, Captain Lundberg has made a contract with a New York firm for the construction of a fleet of steamers of a new type, which will run between Liverpool and New York. Captain Lundberg asserts that he has made a discovery by which the speed of these steamers may be brought up to 21 knots an hour, the passage across the Atlantic being thus reduced to five and a half days. The dimensions of the new steamers are to be as under:—Length, 450 ft.; breadth, 66 ft.; draught of water when loaded, 23 ft. They will be of 10,881 gross tonnage, and the four engines, of 4,500 horse power, will drive two propelling screws. They will be entirely of steel, with double bottoms, and divided into compartments. The proportion of breadth to length will be as one to seven, instead of one to ten, as is generally the case, and this, according to Captain Lundberg, will increase their strength. Above the floating line the new vessels will not differ in appearance from those now running, but there will be a material difference in the hull, for two-thirds of it will be below the floating line, and the screws, instead of being outside, as they now are, will be inside the hold. Another distinctive feature about these new steamers is that the narrowest part of the bow is at the floating point, and that the width gets gradually greater down to the keel, this being the very opposite of the plan hitherto received as the most suitable. These steamers, the first of which is now in course of construction at Washington, will have accommodation for 600 first-class and 1,000 steerage passengers, with a load of 2,700 tons of coal and 550 tons of cargo.

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[*] From the Journal of the Franklin Institute.

EVANS' SAFETY TACKLE.

WE present our readers with a series of drawings illustrating a new aspirant to the honours of a perfect and infallible apparatus for lowering, disconnecting and connecting boats from and to ships' sides. If in the multitude of tackles there be safety, we should hear but little of loss of life from accidents in clearing away the boats, swamping, staving in, &c. Far other is the case. When we read continually the same old tale, when we consider the number of vessels afloat, and the comparative few fitted with any safety appliance at all, we must welcome every new adventurer in the field, trying to do his best to remove the reproach and introduce a new order of things. Nevertheless, this apparatus, the invention of Mr. Edgar J. Evans of Sudbury, Suffolk, has several points of considerable merit, and complies with most of the requirements which are *sine quâ nons* in safety tackle. Figs. 4 and 5 are longitudinal sections of a boat fitted with the appliances, shown in Figs. 4, hanging from the davits, in Fig. 5 on leaving the falls. Figs. 1 and 2 give enlarged views of the safety claw when closed and open Fig. 3 shows the fall block with link attached. The peculiar and ingenious construction of the claw and the mode of fixing in the boat are very clearly indicated in the diagrams. When the safety pins are not inserted, the claws are secured by a span or lanyard running under the thwarts and belayed on one of them. This span bears a very small strain compared with the weight of the boat. The action is then as follows, the boat hanging in the davits with the safety pins in the disconnecting gear. The span tackle fall is hauled tight and belayed, and the safety pins withdrawn. The boat is lowered till water borne, when

FIG. 3.

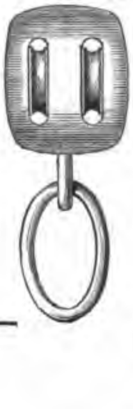


FIG. I.

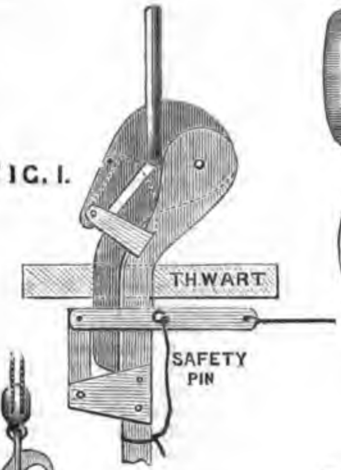


FIG. 2.

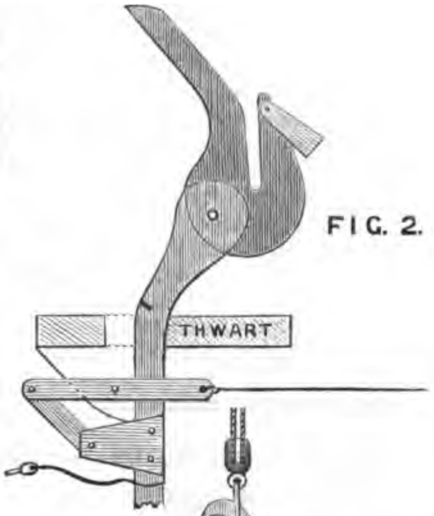


FIG. 4.

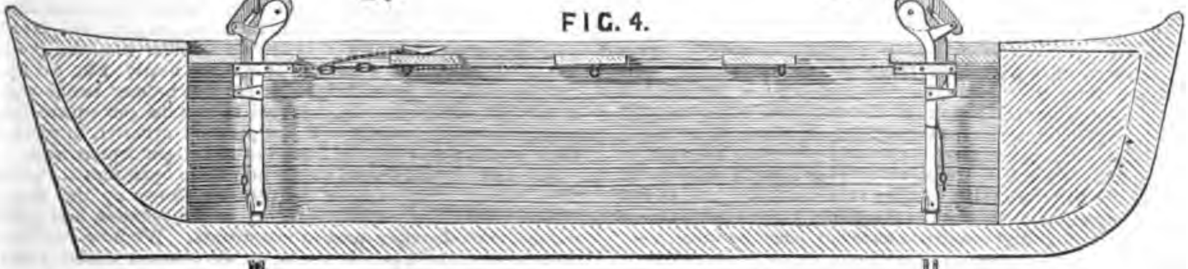
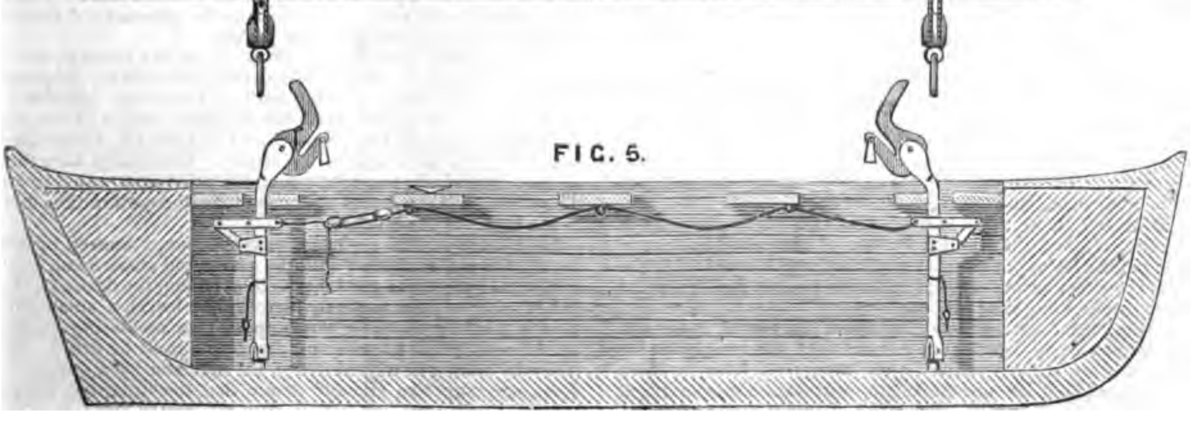


FIG. 5.



the man in charge lets go the fall, the disconnecting gear is released, the claws fly back, and the boat is clear. On returning to the ship the claws are turned down, the disconnecting gear locked with the safety pins, and on coming alongside one man at each end will connect by slipping the links into the hooks, the small moveable tongue permitting ingress, but in this position, when the claws are locked, preventing egress. It is obvious that perfect accuracy and considerable care in manufacture are essential to the perfect working of the apparatus; but taking this condition as fulfilled, several advantages are apparent. Thus both ends of the boat must disconnect simultaneously, and are entirely under the control of one man, who can disconnect without any pull or effort. Only one easy and certain action is necessary in connecting, and here each end acts independently, as great an advantage as it is a disadvantage in lowering. The entire work is done without any lever, hooks, or sheaves, as no leads are required, and there can therefore be no danger to the hands or boat-gear, or risk of hooks catching the thwarts or gunwale. The tackle we have seen certainly works with great ease and efficiency.

ON THE CORRECT METHODS OF TAKING INDICATOR DIAGRAMS.

ANYONE who has often had to carefully analyse indicator diagrams which have been taken at sea, and also in many cases those which have been taken on trial trips at home, must have come to the conclusion that the diagrams, either through want of care in taking them, or through a want of care in arranging the indicator gear, do not always correctly represent the changes of pressure and volume of the steam as they actually occur in the cylinders. We therefore think that we shall be doing good service here in calling attention to some of the points which require careful consideration if the diagrams are to have any scientific value.

An indicator diagram pure and simple is, or ought to be, a diagram or curve, the distance of any point of which, above or below the atmospheric line represents the actual pressure per square inch of the steam at one side of the piston above or below that of the atmosphere, at the instant that the piston has travelled the same proportion of the stroke as the distance of the point from the right or left of the diagram bears to the total length of the diagram. The diagram is formed by the pencil being moved up or down by the steam pressure acting upon the piston of the indicator, while the paper is simultaneously drawn from right to left or left to right by some mechanism worked by the engine itself. We thus see that what we have to do in order to obtain correct diagrams is first to ensure that the vertical motion of the pencil accurately represents the pressure *in* the steam cylinder, and secondly that the travel of the paper accurately represents the relative position of the piston to the stroke of the cylinder.

Now the precautions necessary to ensure the first of these conditions are obviously that the connections from the cylinder to the indicator are of ample sectional area throughout, have no sharp bends in them, and are not choked up with dirt, nor so arranged that water can accumulate in them so that the pressure of the steam in the indicator cylinder shall be the same as that in the engine cylinder; and also, the strength of the spring must be so adjusted that the motion of the pencil shall really represent, on the proper scale, the actual steam pressure acting upon the indicator piston. For instance, if the parallel motion of the indicator is so arranged that one quarter of an inch of travel of the indicator piston produces one inch rise or fall of the pencil, and if the area of the indicator piston is one half square inch, as is usual in indicators, then the strength of the spring of the indicator ought to be such, that, at the temperature at which the spring will be when working, it will be compressed half an inch by a weight in lbs. equal to the number of the scale; that is to say, if the scale is such that one inch of the indicator diagram is supposed to represent a pressure of 16 lbs. per square inch, then a weight of 16 lbs. ought to be capable of compressing the spring just half an inch, when the spring is at the temperature at which it will be when working in the indicator, and also any other weight ought to produce a proportional compression.

We have mentioned this temperature as it is found that any rise of temperature lessens the stiffness of the spring; and as when working with high pressure steam the temperature of the spring often exceeds 300°F, while it is usually tested, if at all, at a temperature of about 60°F, the influence of the temperature is seen to be so much as to render it necessary to take account of it.

The testing of the indicator springs is of great importance, the errors of new springs often being found to be nearly or quite ten per cent., while if a spring is once allowed to get rusty, by remaining in the indicator after it has become wetted by escaping steam, its strength might become impaired to a greater extent than this.

The effect of allowing water to accumulate in the indicator pipes is to alter the diagram, both in the steam and exhaust lines; the distortion being, however, gradual throughout the stroke, generally makes its cause to be looked for in an erroneous valve setting. It is usually only the diagram from the bottom of the cylinder which is influenced by this cause, and the indicator pipes are very often so fitted, that if any water accumulates in the cylinder bottom, it will be drawn into and out of the indicator pipes by the alternate expansion and contraction of the air or vapour filling the upper part of the pipe, caused by the varying steam pressure in the cylinder. When the pressure in the cylinder is great, the air or vapour is compressed by it, the water is forced into the pipe, and the indicator registers a pressure less than the cylinder pressure by the amount of pressure due to the height of the column of water in the pipe. As the pressure in the cylinder becomes less, the expansion of the air or vapour in the pipe, allows the water to fall out of the pipe, and during the exhaust or return stroke, probably there will be no water at all in it and the indicator will then register the correct or nearly correct pressure in the cylinder. The effect of the water is thus to diminish the pressure shown on the diagrams, and this more during the forward than during the return stroke; the work done in the cylinder is therefore greater than credit is given for on the diagrams. When we consider that the pressure due to the height of a column of water is nearly 1 lb. per square inch for each two feet of height, we see that in long stroke engines an error from this cause may exceed 1½ or 2 lbs. per square inch; a very considerable amount in a low pressure cylinder, in which the mean pressure may only be from 8 to 10 lbs. per square inch.

We thus see that several causes may be in operation at the same time, each tending to make the pressure shown by the diagram different from that actually existing in the cylinder, and making the diagrams therefore more or less useless. We now consider the other motion of the pencil, that is, we will consider common sources of error in the diagram, as representing the pressures of the steam at corresponding positions of the *piston*.

The necessary condition for accuracy on this point is, that the motion of the paper cylinder should always be exactly proportional to that of the piston. The motion is given to the cylinder from some point of the engine which has a *similar* motion to the piston, but a less range, in the proportion of the length of the diagram compared with the length of the stroke. Two things have thus to be attended to, viz., the selection of the point from which to derive the motion, and the means of transmitting the motion thus derived to the barrel of the cylinder.

In ordinary vertical engines having the pumps worked by levers, having one end connected with the piston rod cross head, a point in the lever presents a good means of obtaining the desired motion; and in other engines in which there are no levers, a small lever is usually specially made for this purpose. In oscillating engines a special contrivance for reducing the motion must be fitted. In all cases the motion is transmitted to the indicator by a string. Too great care cannot be taken to ensure that the string has been well stretched before use, and that it does not stretch while in use, as a new string which has not been well strained is usually so elastic that a considerable variation takes place in its length according to the force necessary to overcome the spring of the indicator barrel, which force is greater when the barrel is at one extremity of its motion than when it is at the other.

Care must be taken also that the point of the lever chosen for communicating the motion is such that when the piston is at the centre of the stroke the lead of the string is as nearly as possible at right angles to the line joining the point with the centre of oscillation of the lever. Unless this is attended to, grave errors will be introduced; for instance, if the point chosen is higher than this condition requires the diagram will be greatly distorted at its upper end, a proportionally much smaller motion of the indicator

BRUSH" SYSTEM OF ELECTRIC LIGHTING.

(For description see page 115)

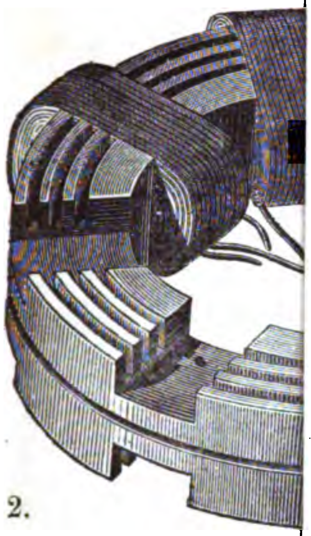


Fig. 2.

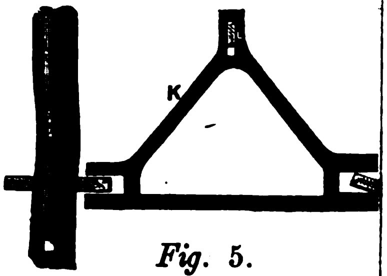


Fig. 5.

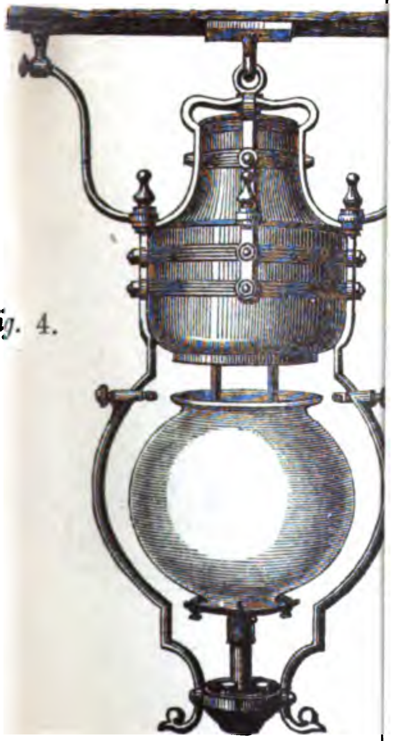


Fig. 4.

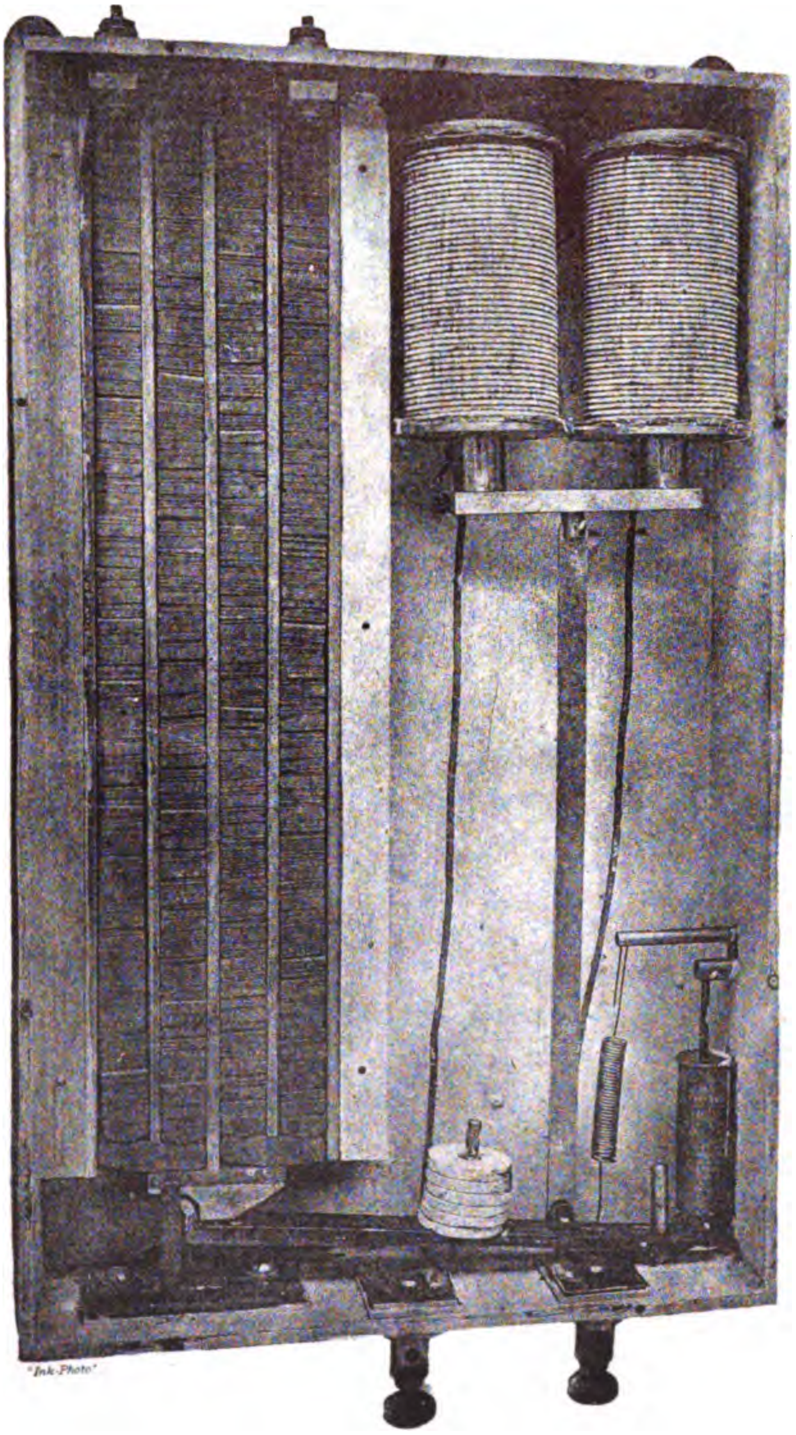


Fig. 7.

[illegible] & Cº 22 Martins Lane Cannon St EC

barrel being caused at this part of the stroke than should be the case, and if the point chosen be too low, the other end of the diagram will be similarly distorted.

There is one further point too often neglected. The indicator diagram necessarily gives the steam pressures above or below the atmospheric pressure as measured from the atmospheric line, and as the atmospheric pressure varies from day to day it is necessary, if the absolute pressures of the steam are to be determined, to know the pressure of the atmosphere; the height of the barometer should, therefore, always be recorded on the diagrams along with the particulars of the date the steam pressure, vacuum and number of revolutions. If the only thing to be determined is the power developed, it is of course immaterial whether the barometric height is recorded or not; but without it the diagrams are nearly useless for any scientific purpose, while as a means of comparing the performance of the engines at any time with that at a previous time, when diagrams had been taken, it is often necessary, especially with low pressure diagrams, to know the absolute pressures of the steam, which, as we have stated, cannot be determined from the diagrams without a knowledge of the exact atmospheric pressure at the time they were taken.

We thus see that, simple as the matter generally is considered, special attention is necessary to several points, if the indicator diagrams are to be accurate indications of the working of the steam, and we recommend a careful consideration of all these points to any of our readers, especially to sea-going marine engineers, whose duty leads them to take indicator diagrams.

THE SHIPWRIGHTS' COMPANY'S EXHIBITION.

(*Continued from page* 81.)

MESSRS. JOHN ELDER & CO., of Fairfield, Glasgow, exhibit models of the *Alaska*, built for Messrs. Guion & Co.; of the Imperial yacht *Livadia*, built for the late Emperor of Russia; and of the *Stirling Castle*, recently built for Messrs. Thomas Skinner & Co., for the China tea trade. Another fast vessel, the *Austral*, completed recently by this firm for the Orient Steam Navigation Company, trading between London and Australia, is shown.

The Barrow Shipbuilding Company contributed the model of the *City of Rome;* a model of the paddle steamer *Adelaide*, built for the Great Eastern Railway for service between Harwich and Rotterdam; and a model of the screw yacht *Aries*, built for Sir James Ramsden.

Messrs. Short Brothers, of Sunderland, showed a model of a large cargo-carrying steam vessel, for trade between Europe and the East, *via* the Suez Canal; and in Class 4 of the same section, models of three other vessels, two of which are for the Black Sea trade, and the other—a self-trimming collier—for the Baltic.

The *City of Rome*—a model of which was shown by the builders—the Barrow Shipbuilding Company—was launched last year, and is, next to the *Great Eastern*, the largest vessel afloat. Her length over all exceeds 600 ft. Her breadth is 52 ft. 3 in., and her depth of hold is 37 ft.. The gross tonnage is 8415 tons, and the displacement is 13,450 tons. Her engines, which are also manufactured by the Barrow Shipbuilding Company, are compound-inverted, direct-acting, surface-condensing, with six cylinders, the diameter of each of the three high-pressure cylinders being 43 in., and of the low-pressure cylinders 86 in. The length of the stroke is 72 in., and the steam pressure 90 lb. per square inch. She has eight boilers; cylindrical return-tubular, fired from both ends. The propeller is four-bladed, and has a diameter of 24 ft. Her engines are capable of developing 10,000 indicated horse-power, with an estimated speed of 18 knots. The vessel has already made two passages across the Atlantic, and has lately arrived at New York after a voyage of about eight days. The excellent workmanship in the model of this vessel we have previously alluded to. Her appearance, which is enhanced by the elegant clipper bow, is, we think, all that can be desired, her graceful outline reminding one of a pleasure yacht. The *City of Rome* is constructed of iron with the ordinary system of transverse floors and framing, but her plating, instead of being arranged with raised and sunken strakes in the way now usual in shipbuilding, is worked flush upon the frames with doubling strakes along all the longitudinal seams—a plan which is of great strength, and which has been adopted by the Barrow Company in building previous vessels for the North Atlantic trade. She is divided into eleven water-tight compartments, so that should any one compartment be pierced through collision, grounding, or otherwise, the vessel would still be able to keep afloat; and in the event of her machinery becoming disabled she has sufficient sail power to enable her to proceed on her voyage under canvas alone. The vessel has four decks, three of which are of iron. Being of such great length, especial care was necessary in preparing her design to insure sufficient longitudinal strength to resist the enormous strains to which she will be subject when crossing large Atlantic waves, and she has been built to receive the highest class at Lloyd's. She has a water ballast tank capable of holding nearly 380 tons of water for trimming purposes. The *City of Rome* has spacious passenger accommodation. Her state rooms are capable of receiving 290 saloon passengers. In addition she has sleeping quarters on the main deck alone for 500 emigrants, and 1,000 more could be carried on the lower deck. The saloon is 72 ft. in length; it extends from side of the vessel, and can accommodate about 250 people at dinner. The state cabins of the saloon passengers are somewhat larger than usual, and of great height, there being a distance of about 9 ft. between decks. Above the upper deck is a promenade deck carried out to the sides amidships, and enclosing officers' cabins, saloon, galley, &c. The ends of the vessel are protected from head and following seas by a forecastle and a turtle back poop.

The *Servia*, exhibit No. 293, was built last year by Messrs. J. & G. Thomson, of Clydebank, for the Cunard Company, and greatly exceeds in length and tonnage any of the previous vessels owned by the same company. Her extreme length is 530 ft., breadth 52 ft., and depth of hold 37 ft. Her gross tonnage is 7,400 tons, and her displacement is about 13,000 tons. When on her measured mile trials she attained the high speed of 17·85 knots with 10,350 indicated horse-power, but this speed could, of course, not be maintained throughout an Atlantic voyage. The engines of the *Servia* are of the three-cylinder direct-acting compound surface-condensing type, the high-pressure cylinder having a diameter of 72 in., and the two low-pressure cylinders are each 100 in. in diameter. The length of stroke is 78 in., the steam pressure is 90 lb. per square inch, and the revolutions 53 per minute at the speed of 17·85 knots. This vessel has already made three voyages across the Atlantic, and her fastest passage took only 7 days 7 hours 41 minutes—a record which has been beaten only by the *Alaska* and *Arizona*.

The *Servia* is constructed of steel, on the system known as the longitudinal and bracket system, with a complete double bottom, forming a continuous arrangement of water ballast tanks capable of holding 800 tons of water. She has twelve water-tight bulkheads, eight of which extend to the upper deck, and thus, as in the *City of Rome* and other modern passenger steamers, she would be enabled to remain afloat if any one compartment were injured. The *Servia* has accommodation for about 1,000 passengers, for 500 of whom first-class accommodation is available, and on her lower deck there is room for an additional 1,000 emigrants. The grand saloon, which measures 72 ft. in length and 50 ft. in breadth, is capable of accommodating 350 people at dinner; and the vessel generally is most luxuriously furnished. The appearance of the *Servia* afloat is very unlike that of the *City of Rome*, on account principally of her stem being nearly upright, and without any of the projection or overhang which forms so attractive a feature in the appearance of the latter vessel.

The sister vessels, *Britannic* and *Germanic*, two of the most successful of modern passenger vessels trading between England and America, represented by models, were exhibited by the owners, Messrs. Ismay, Imrie, & Co., of the White star line. The *Britannic* was built by the eminent firm of shipbuilders, Messrs. Harland & Wolff, of Belfast, in 1874, and the *Germanic* by the same firm a year later. Their principal dimensions are: length between perpendiculars, 455 ft.; length over all, 468 ft.; breadth extreme, 45 ft. 3 in.; and depth of hold, 34 ft. The gross register tonnage is 5,000 tons, and the displacement on a draught of water of 23 ft 7 in. is 8,500 tons. They are constructed of iron, on what is known as the transverse or ordinary system of framing, and are divided into numerous water-tight compartments by transverse bulkheads. Their engines are compound, vertical, direct-acting, with four cylinders, the two high-pressure having a diameter of 48 in., and the low-pressure a diameter of 83 in. The length of the stroke is 60 in., and the working pressure in the boilers is 65 lb., per square inch. Each vessel has eight boilers, each boiler being fired from both ends. The propeller has a diameter of 23 ft. 6 in., with a pitch of 31 ft. 6 in., and makes fifty-two revolutions with 4,900 indicated horse-power. When the *Britannic* was built, the propeller was fitted in such a manner as to enable it to be lowered when at sea. The supposed advantages of this plan, which was suggested by Mr. Harland, the senior partner of the firm of Messrs. Harland

and Wolff, were that the propeller would work in comparatively undisturbed water, and would be therefore more efficient, and that the racing of the engines, which takes place when the vessel is pitching heavily, would be avoided, as the propeller would be kept well below the surface of the water. It was found, however, that there were many disadvantages connected with this plan, and the *Britannic* has now been fitted with a propeller in the ordinary way. For some years these two vessels have been among the fastest of the passenger vessels trading between Liverpool and New York. It is on record that the *Britannic* made the passage from New York—Sandy Hook—to Queenstown, a distance of 2,882 knots, in 7 days 12 hours 41 minutes, with an average speed of 15·95 knots per hour; and the *Germanic*, in April, 1877, made a passage from Queenstown to New York in 7 days 11 hours 37 minutes, covering a distance of 2,830 knots, with an average ocean speed of 15·75 knots per hour. Each of these vessels has accommodation for 1,300 passengers. Like other passenger steamers of large size, they have extensive deck houses covered by a promenade deck extending to the sides for a part of the length amidships, and a turtle back forecastle and hood have been fitted for protection against head and following seas.

The *Alaska*, the most recent addition to the well-known Guion line of passenger steamers trading between Liverpool and New York, was built last year by Messrs. John Elder & Co., of Fairfield, and has made the fastest passage on record between the Old and the New Worlds. Her launch, which took place in July last, was unfortunately not completed on the day proposed, as she stuck fast upon the ways, but she was subsequently launched without injury. Her principal dimensions, as registered by the Board of Trade, are:—Length, 500 ft.; breadth, extreme, 50 ft.; and depth of hold, 38 ft.; and with a gross tonnage of 6932 tons, she has a displacement exceeding 12,000 tons. The *Alaska* is built of iron on the transverse system of framing, to receive the highest class at Lloyd's, and her bulkheads, which are nine in number, are so arranged as to qualify her for entry on the Admiralty list. Upon the upper deck she has a turtle back forecastle nearly 100 ft. long, a bridge deck and promenade flat about 330 ft. long, covering the saloon skylight casing, officers' cabins, engine and boiler casing, galleys, &c., and a turtleback poop about 55 ft. in length. She has four masts, barquentine rigged, with a fair amount of sail power.

One peculiarity noticeable in this handsome model is the sharp cutting away of the fore-foot, a practice which we believe was first introduced by Messrs. Harland & Wolff, and now frequently followed by other builders with excellent-results, both as regards speed and easy handling.

The engines of the *Alaska* were also manufactured by Messrs. Elder. They are of the compound inverted direct-acting type, with three cylinders, the high-pressure cylinder having a diameter of 68 in., and the two low-pressure a diameter each of 100 in. The length of the stroke is 72 in., and the propeller, which is four-bladed, has a diameter of 23 ft. 3 in. and a pitch of 34 ft. 6 in. The boilers are built of steel, they are nine in number, they have each a diameter of 15 ft., and are cylindrical double-ended with a working pressure of 100 lb. per square inch. Each boiler has six furnaces, with an aggregate grate surface of 138 sq. ft.

The estimated maximum speed of the *Alaska* is 18·5 knots with 11,000 indicated horse-power; but, as at the time of leaving the Clyde for Liverpool, prior to entering upon the passenger service, the fitments in connection with the whole of her boilers were not completed, no full powered measured mile trials, we believe, were made. The *Alaska* has large and luxurious passenger accommodation for over 300 first-class passengers and for a large number of second and third-class, and carries 4,000 tons of dead-weight cargo.

The fastest passages on record across the Atlantic were made by the *Alaska* on her last voyage out and home, her average ocean speed outwards was 16·7 knots per hour, the distance between Queenstown and New York having been covered in seven days four hours thirty-two minutes, which is two hours eleven minutes less than she took on her previous homeward voyage, and four hours seven minutes less than the fastest passage made by her sister vessel the *Arizona*. She has just made the return passage in seven days one hour.

The *City of Berlin*, a model of which was exhibited by Messrs. Inman, was built by Messrs. Caird & Co., of Greenock, in 1875. Her principal dimensions are:—Length over all, 520 ft.; breadth, extreme, 44·2 ft.; and depth of hold, 34·9 ft. The gross registered tonnage is 5491 tons, and the displacement exceeds 10,000 tons. Her engines, which were also manufactured by Messrs. Caird & Co., are compound inverted direct-acting, with two cylinders, the high-pressure having a diameter of 72 in., and the low-pressure a diameter of 120 in. The length of the stroke is 66 in., and the pressure in the boilers is 75 lb. per square inch. The *City of Berlin* attained on the measured mile a maximum speed of 14·825 knots per hour with 5,200 indicated horse-power. At the time of her construction she beat all previous records on the voyage from Queenstown to New York. Her fastest passage was made in October, 1877, when she arrived at New York within seven days fourteen hours twelve minutes of the time of leaving Queenstown—a record which is only eleven hours forty minutes in excess of the *Alaska's* shortest. She carries 202 first-class passengers and 1,500 other passengers and emigrants. The *City of Berlin*, like the other vessels of the Inman Line, has a handsome clipper bow similar to the *City of Rome's*, previously referred to.

The sister vessels, *Garth Castle* and *Drummond Castle*, were completed last year by Messrs. John Elder & Co., for Messrs. Donald Currie & Company's Cape Mail Line. The dimensions of these vessels are as follows:—Length, over all, 376 ft.; breadth, 43 ft. 6 in.; depth of hold, 31 ft. 4 in.; and the gross tonnage is about 3,700 tons. They have compound inverted direct-acting two-cylinder engines, the high-pressure cylinder being 51 in. in diameter, and the low-pressure 88 in., with a length of stroke of 57 in., and a steam pressure of 75 lb. per square inch. The indicated horse-power developed on the measured mile was 3,325 with a maximum speed of 14·3 knots, the engines making 66 revolutions. These vessels, in addition to their large cargo-carrying capacity, have considerable passenger accommodation, including berths for 166 first-class passengers, eighty second-class, and 130 third-class. For greater safety at sea, and to qualify them for a place in the Admiralty list, they are subdivided into nine separate water-tight compartments, and they have provision for water ballast to the extent of nearly 400 tons. Special provision has been made in these vessels to secure adequate pumping power in the event of any compartment being injured, although the flooding of any one compartment would not of itself imperil the safety of the vessel.

The vessels represented in the exhibition and belonging to the well-known Monarch Line, owned by the Royal Exchange Shipping Company, deserve more than a passing notice. Three of these vessels have been built by Messrs. McMillan, of Dumbarton, and two others by Messrs. Earle, of Hull. The *Assyrian Monarch* and the *Lydian Monarch* are constructed of mild steel, and the others of iron. They are all built on the cellular, longitudinal and bracket system, and have capacity for about 600 tons of water ballast between the inner and outer bottoms. With the exception of the *Grecian Monarch*, which has been made longer than the others, these vessels are all of the same size, their principal dimensions being:—Length over all, 371 ft.; breadth, 43 ft.; and depth of hold, 24 ft. 10 in. The gross tonnage, including the shelter deck, is nearly 4,000 tons.

The engines with which they are fitted are compound inverted two-cylinder direct-acting, the high-pressure cylinder having a diameter of 46 in., and the low-pressure 87 in. The length of the stroke is 57 in., and the steam pressure in the boilers is 80 lb. per square inch. They have a speed of from 12 to 13 knots with about 2,500 indicated horse power.

These vessels are engaged in the Atlantic Trade between London and New York, and have a special arrangement of centre-line partitions, constructed of iron, for the carriage of grain in bulk in the lower hold, and between lower and middle decks, on the homeward voyages. These partitions serve to prevent the shifting of the loose grain from side to side of the vessel during heavy weather at sea, it having frequently been found that in grain-carrying vessels where no such provision has been made the loose cargo has shifted to such an extent as to produce a considerable list, and this, accompanied by a consequent diminution of stability, has been doubtless a fruitful source of loss of life and property. We may remark that the Board of Trade regulations require in grain-carrying vessels not so fitted that one-third of the cargo shall be stowed in bags.

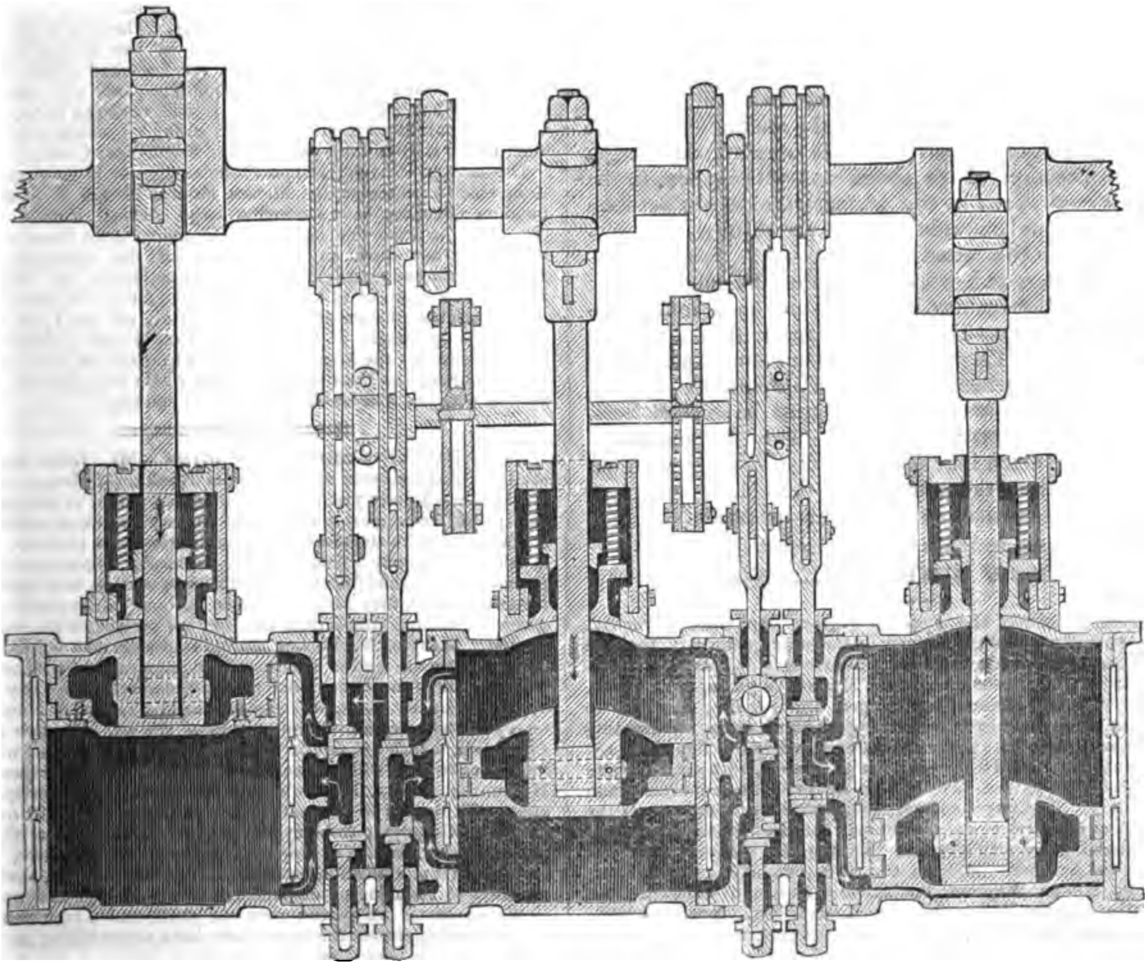
These vessels are all fitted with a complete shelter deck for the purpose of carrying cattle on the return voyage from New York. They have limited first-class passenger accommodation, but they can carry in the 'tween decks nearly 1,500 emigrants. They are each divided into seven water-tight compartments, so as to comply with the requirements for entry on the Admiralty list. The models show these vessels to be of comparatively full form, so that they are capable of carrying a large amount of deadweight cargo.

A very handsome model of the *Grecian Monarch* was exhibited by the builders, Messrs. Earle's Shipbuilding Company, of Hull. The model was shown for competition in Section B, Class 4, for Atlantic cattle and grain steamers, and her builders were awarded the first prize, a gold medal.

The *Stirling Castle*, a model of which was exhibited by the builders, Messrs. John Elder & Co., of Fairfield, has been built for Messrs. Skinner & Co. for the above service. This vessel on her trial trip in March last attained on the measured mile the very high speed of 18·4 knots with 8,500 indicated horse-power. This speed, we believe, is equal to any attained even by the large transatlantic passenger steamers, and is far in excess of that hitherto obtained in purely cargo carrying vessels.

The *Sterling Castle* is built of iron to receive Lloyd's highest class. Her model shows her to have considerably greater rise of floor than is usual in either cargo or passenger steamers, and her lines, which are very fine, present to the eye the appearance of being adapted for a very high rate of speed. Her length between perpendiculars is 420 ft.; breadth, 50 ft.; and depth of hold, 30 ft. 10 in. The gross register tonnage is about 4,500 tons, and the displacement at the load draught exceeds 8,000 tons. She is constructed on the ordinary system of framing; she has two complete iron decks and seven water-tight bulkheads, which divide her into eight independent water-tight compartments, by which the Admiralty's requirements for admission to their list of vessels suitable for service as a cruiser in time of war are complied with. Upon the upper deck she has a long bridge enclosing the engine and boiler casings, and a poop and forecastle.

The engines of the *Stirling Castle*, which were made by the builders of the vessel, are compound inverted direct-acting, with three cylinders, the high-pressure cylinder having a diameter of 63 in., and the two low-pressure cylinders a diameter each of 90 in. The length of the stroke is 72 in., and the steam pressure in the boilers is 100 lb. per square inch. She has a four-bladed propeller with a disc diameter of 22 ft 4 in., and a pitch of 31 ft. Her boilers six in number, are constructed of steel; they are cylindrical, double-ended, are each fitted with six furnaces, Fox's patent, manufactured by the Leeds Forge Company. The *Stirling Castle* will, it is estimated, be able to carry over 5,000 tons measurement of tea, and as a ton measurement of tea occupied 40 cubic ft. and weighs 8 cwt., this represents a dead weight cargo exceeding 2,000 tons.



W. TURNBULL'S PATENT EXPANSIVE MARINE ENGINE.

We give this month a sectional drawing of the improved duplicate three-cylinder expansive marine engine, of which a model was exhibited at the late Naval Exhibition by the inventor, Mr. W. Turnbull, New Hampton, Middlesex. These engines are designed with the special objects of utilizing space, and coupling together the pistons and cranks direct from the piston rod. Thus trunks, crossheads, motion-blocks, guide-bars *et hoc genus omne* are dispensed with, whereby considerable loss from condensation and friction is avoided. The steam, the course of which can be traced by the white arrows, is admitted from the boiler to the centre cylinder, whence by suitable ports and passages, as shown, it is transmitted to the side cylinders where the expansion is completed. The exhaust of each cylinder communicating with the condenser, considerable economy and uniformity of motion is obtained. Condensation in the steam cylinders is reduced by super-heating and the employment of casings or liners of thin cast steel with flanges—the intervening annular space being packed with some non-conducting material. As will be seen from the engraving, the cranks of the outside cylinders are fixed on opposite centres, 90° respectively before and behind the centre crank. The black arrows on the piston rods show the simultaneous motion. The steam valve of the centre cylinder is worked by a separate link motion and regulates the amount of steam. The other valves and link motions work in unison and always at full traverse.

It will be seen that a special and ingenious arrangement is introduced in the stuffing boxes and glands of the piston rods. These are arranged with a flange or disc, working steam tight on the convex surface of the cylinder cover, in a slot in which the piston rod moves. The stuffing box is kept in position by a couple of radius rods and a short cross-bar, having two spiral springs between the latter and the top of the stuffing box. The friction that would result from the pressure due to the angular direction of the piston rod with respect to the crank, is neutralized by the admission of steam between the cylinder and one side of the pistol through a double-acting valve in the latter.

The cylinders and working parts of the engine being of the same dimensions, the construction is much simplified, and the cost consequently reduced in a proportionate degree. Engines on this plan would seem well adapted for use where height is of importance, and for war steamers where the engine must be placed horizontally to the screw shaft. The designs show considerable scientific skill and care in their working out, and we trust the patentee will be able to secure an extended and satisfactory trial of his invention.

NEW SHIPS BUILDING.

THE reputation of the Tyne as a great shipbuilding river has been fully maintained recently by the large quantity of tonnage turned out of the yards of Messrs. Palmer & Co., Jarrow & Howdon; Messrs. A. Leslie, Hepburn; Messrs. Wigham, Richardson, & Co., Walker; Messrs. Schlesinger, Davis & Co., &c. Up to June 30, 1881, there were launched 53 screw steamers, representing a gross registered tonnage of 79,807 tons, while the figures for the corresponding period this year are 56 vessels, with an aggregate tonnage of 95.419 tons, showing an increase of three vessels, and 15.612 tons. The large increase in the amount of tonnage over the number of steamers is an indication that the demand for vessels of greater tonnage still prevails. During the half-year only one steel vessel has been built on the Tyne, namely, a fine Atlantic liner, by Messrs. Wigham, Richardson, & Co., to trade between Bristol and New York. Messrs. J. Readhead, South Shields, have launched six steamers during the half-year, representing 9,098 tons and 810 horse power nominal. Out of four vessels launched by the Tyne Iron Shipbuilding Company (Limited), Willington Quay, three were for North Shields owners, showing the firm has had a good hold on the home market. The prospect for the incoming months is, on the whole, healthy, most of the firms having orders to carry them well over next year, but in more than one yard it is stated that the last keel on order has been laid down. During the past three or four months there has been a falling off in the inquiries and in the booking of orders, owing perhaps to the low freights which have prevailed in the leading trades.

THE shipyards in the Tyne are now fully engaged, though there is some falling off in the orders for new steamers. At Messrs. Hepple's yard, North Shields, the wooden tug for the Cape Government is now far advanced, and will be ready shortly to leave the Tyne. The barque *Mary* is now in Messrs. Young & Co.'s dock, North Shields, remetalling and receiving other repairs. At Whitehill Point shipbuilding yard a large paddle tug for Scarborough owners will be finished in a few weeks. At the Tyne Iron Shipbuilding Company's yard at Willington Quay four steamers are on the stocks in various stages of construction; two are for local, one for Cardiff, and the fourth for London owners. At Messrs. Boutland's yard, South Shields, the schooner *Isabel* is in the dry dock undergoing repairs, and alongside the quay the barque *Duke* is having her bulwarks renovated, and some other deck damage put right.

SHIPBUILDING has been exceptionally brisk at West Hartlepool in the half-year now closing. At the yard of Messrs. Gray & Co. there have been launched nine vessels, whilst eleven have been finished. There are now on the stocks six vessels, several of them well advanced in construction. Altogether, the work of the yards is one of the best, if not the best, result that has been known in any first half-year; and, though there is a check to the inquiries for new vessels, the orders that are in hand are sufficient to give active work for the remainder of the year at all the shipbuilding yards in the Port.

FIFTY-SIX vessels were built in the Wear during the past six months, the aggregate tonnage of which amounted to 96,651 tons, and the total nominal horse-power 9,454. Three new yards have been started during the past half-year, at one of which (Messrs. Kish, Boolds, & Co.) a new steamer was launched within the past month. Though the work in shipbuilding-yards and the marine engine building works in the Wear is still reported brisk, there is evidently an indication of new orders falling off, which is the case at most of the shipbuilding-yards on the North-East Coast.

IMPORTANT SHIPBUILDING CONTRACT.—It is very gratifying to be able to announce that Messrs. Robert Napier & Sons, shipbuilders, Glasgow, have secured a large contract from a firm in Genoa. The order that has just been booked is for three steamers of 4,000 tons each, or 12,000 tons in the aggregate. The vessels are intended for the traffic between Genoa and the River Plate, and a speed of 15 knots is stipulated for in the specification.

THE celebrated dock at St. Peter's Quay, on the Tyne, so long conducted by Messrs. T. W. Smith & Co., is now being filled up. It is intended by the Messrs. Hawthorn to carry on very extensive engine works; the dock will, therefore, retain its character in connection with the Mercantile Navy of this country.

NEW PATENT COMPOUND ENGINE.—Mr. John and Mr. Matthew Rankin, sons of Mr. Daniel Rankin (of Messrs. Rankin & Blackmore), have just taken out a double patent in one for triple and quadruple-expansion compound engines for disconnecting twin screw and paddle steamers. The public are aware that Mr. Daniel Rankin has already a patent double-expansion disconnecting compound surface-condensing engine for twin screws, and that in all instances where they have been fitted on board steamers they have given the utmost satisfaction, and they are perfect for the work intended. Many of our leading marine engineers now hold that the present types of double compound engines cannot economically utilize steam of more than 80 to 90 lbs. pressure; hence the departure made by Mr. Kirk, of Glasgow, and Mr. Taylor, of Newcastle-on-Tyne, with regard to the engines of the s.s. *Aberdeen* and s.s *Claremont*, which are on the triple expansion system, and working most successfully with pressures of 125 and 150 lbs. respectively. Hence, the Messrs. Rankin's idea of carrying this principle into effect with respect to twin screws and paddles. They got over the difficulty of applying three cylinders by subdividing either the high pressure, intermediate, or low pressure cylinders into two. Suppose the first modification be taken, as it is the simplest, saving the necessity of reducing or expansion valves:—A high and an intermediate cylinder are placed over one shaft, and a high and a low pressure cylinder over the other shaft, both sets working in unison ordinarily, as a triple expansion engine, by means of suitable connections. The steam is admitted from the boiler at a pressure of, say, 150 lbs. to the two high-pressure cylinders which exhaust simultaneously into the intermediate cylinder, and it in turn exhausts into the low pressure cylinder, from which the steam finally passes into the condenser to return again to the boiler. As these engines will effect a saving of at least 20 per cent. over the ordinary type, it will be seen that they are specially adapted for long voyages and to countries where coal is dear. The quadruple expansion engine is intended for still higher pressures than the above. In it the steam passes from a high pressure cylinder to one intermediate, and then into another of larger size which exhausts into the low pressure cylinder. The Messrs. Rankin do not intend to push this latter in the meantime. as it is rather a-head of the times, and a suitable boiler has yet to be invented, but they believe there is an immediate future before the triple expansion engines, for which the common tubular boiler is well adapted.

A.D. 1885.—THE FRENCH AND ENGLISH NON-OBSOLETE FLEETS IN BATTLE ARRAY.*

FRENCH.	Description.
1 (A) Adml. Baudin	To mount from 100 to 72-ton guns
c2 (A) Formidable	,, ,, ,,
c3 Caîman	,, ,, ,,
c4 Indomptable	,, ,, ,,
c5 Requin	,, ,, ,,
c6 Terrible	,, ,, ,,
7 Admiral Duperré	To mount 48-ton guns.
8 Devastation	,, ,, ,,
9 Foudroyant	,, ,, ,,
10 Magenta	,, ,, ,,
11 Neptune	,, ,, ,,
12 Hoche	,, ,, ,,
13 Marçeau	,, ,, ,,
14 Vengeur	,, ,, ,,
15 Tonnant	,, ,, ,,
16 Fulminante	To mount 34-ton guns
17 Furieux	,, ,, ,,
18 Tonnerre	,, ,, ,,
19 Tempête	,, ,, ,,
20 Redoubtable	To mount 20 ton guns.
21 Colbert	,, ,, ,,
22 Trident	,, ,, ,,
23 Richelieu	,, ,, ,,
24 Friedland	,, ,, ,,
25 Marengo	,, ,, ,,
26 Suffren	,, ,, ,,
27 Océan	,, ,, ,,
28 (B) Bayard	,, ,, ,,
29 (B) Turenne	,, ,, ,,
30 Duquesclin	,, ,, ,,
31 Vauban	,, ,, ,,
32 Lagallissionaire	,, ,, ,,
33 Victorieuse	,, ,, ,,
34 Triomphante	,, ,, ,,

4 Others ordered.
—
38 *Seaworthy* to 35 English!!!
9 Wood. Two new wood completing (B)
—
29

The *Budget de l'Exercise*, 1882, promises the completion of these ships in 1885.

Sir Thomas Brassy in his book, page 316, states "that the two ships (A), and two others, are to be armed with 100-ton guns, to be complete in 1885."

The French have 16 building, English 10.

ENGLISH.	Description.
1 (E) Inflexible	To mount 80-ton guns.
2 Collingwood	To mount 43-ton guns.
3 (E) Majestic	,, ,, ,,
4 (E) Colossus	,, ,, ,,
5 Conqueror	,, ,, ,,
6 Dreadnought	To mount 38-ton guns.
7 Thunderer	,, ,, ,,
8 Devastation	To mount 35-ton guns.
9 (E) Agamemnon	To mount 38-ton guns.
10 (E) Ajax	,, ,, ,,
11 Neptune	,, ,, ,,
12 Alexandra	To mount 25-ton guns.
13 Téméraire	,, ,, ,,
14 Monarch	,, ,, ,,
15 Belleisle	,, ,, ,,
16 Orion	,, ,, ,,
17 Hotspur	,, ,, ,,
18 *Glatton	,, ,, ,,
19 Sultan	To mount 18-ton guns.
20 Superb	,, ,, ,,
21 Hercules	,, ,, ,,
22 Impérieuse	,, ,, ,,
23 Warspite	To mount 18-ton guns.
24 Northampton	,, ,, ,,
25 Nelson	,, ,, ,,
26 Rupert	,, ,, ,,
27 Shannon	,, ,, ,,
28 *Gorgon	,, ,, ,,
29 *Hydra	,, ,, ,,
30 *Clyclops	,, ,, ,,
31 *Hecate	,, ,, ,,
32 **Triumph	To mount 12-ton guns.
33 **Swiftsure	,, ,, ,,
34 **Invincible	,, ,, ,,
35 **Iron Duke	,, ,, ,,
36 **Audacious	,, ,, ,,

4 Others ordered.
—
40
5 {Marked * unseaworthy, except in "fine weather from port to port."—Design Committee Report.
—
35 Seaworthy!!!
5 {**Faulty construction, armament, armour, &c., contemptible comparatively.
—
30
5 {(E) experimental, as to armour of which I entertain strong disapproval.
—
25

Of Obsolete Armoured Ships the French have 23, English 20.

Our Unarmoured Squadron is in my opinion lamentably inefficient. Squadrons of Instruction prove the starved state of our Navy. Grand total:—English, 60; French 61—most unsatisfactory.

N.B.—The Names, &c., of the above Ships are taken from an Admiralty official paper, see B, C, D, E, F, and confirmed by a Lord of the Admiralty Sir Thomas Brassey, K.C.B., also the "Budget de l'Exercise," 1882, which means French Naval Estimates, 1882.

* *Our Great Peril; if war overtake us, with our Fleet Deficient in Number, Structure, and Armament.* By Admiral of the Fleet, Thomas M. C. Symonds. G.C.B. London: W. Kent, 23, Paternoster Row, E.C.

Review.

The Boiler Maker's Ready Reckoner, with Examples of Practical Geometry and Templating for the use of Platers, Smiths, and Riveters. By John Courtney. London: Crosby Lockwood & Co.

Some time ago we noticed the handy little "Boiler Maker's Assistant" of this author, and we have pleasure in bestowing the same approbation on this not inconsiderable volume as on its more modest predecessor. This applies to the really practical portion of the work, for when he lapses into theory, Mr. Courtney, even under the supervision of Mr. Kinnear Clark, is by no means infallible. We have not thoroughly examined every proposition, but the second on p. 1 is a palpable blunder. To bisect a given line AB from a point without the line, as at C, is a very different thing from drawing a perpendicular to AB from C, which is all the proof establishes. As a matter of fact, the so-called bisector is so only in a special case. Again, the mode given on p. 6 to draw an ellipse is decidedly empirical and involves constructions about as difficult as the original problem. But as these theorems only comprise 24 pages out of 350, we may excuse them for the sake of the good matter behind. These include, among other tables, diameters and circumferences of plate-iron cylinders, weights of plates, bars, angles and T-iron, and diameters and circumferences of angle iron rings. The latter table is very complete, giving for both inside and outside flanges the circumferences for diameters from 8 inches, rising by eighths to 12 feet 9 inches, for diagonal measurements of root from 3·8 inches, rising by sixteenths to 1 3-8 inches. There is appended a useful wages table and rivet reckoner. The book, as a book of figures should be, is admirably printed in bold, clear type, on strong paper; and, as a book of reference should be, is strongly and neatly bound. We can commend it as a useful workmans assistant.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

James Jackson.—On June 19th a small wooden screw trawler was launched from Heskitt's Yard, South Shields. The boat has been built by and for Mr. Jackson. and is 60 ft. long, 14 ft. wide, and 8.2 ft. depth of hold. She has been fitted with two 12 in. cylinders. She was christened the *James Jackson.*

Leander.—On June 24th Mr. W. B. Forwood's new 46 ton cutter, built by Messrs. Inman & Son, was launched from this firm's yard at Leamington. Mrs. Bousfield, the wife of the Vicar of Hordle, performed the christening ceremony, naming the yacht *Leander.* The yacht's dimensions are:—Length L.W.L., 64 ft.; beam extreme, 13 ft.; depth, 9 ft. 6 in.; tonnage, 46 T.R.A., 50 tons builder's measurement. Immediately after being launched she was taken under the sheers to receive her mast and ballast.

Newent.—On June 29th there was launched from Messrs. Short Brothers' shipbuilding yard at Pallion, Sunderland, an iron screw steamer, built to the order of a local firm, of the following dimensions:—Length, 216 ft.; breadth, 30 ft. 6 in.; and depth, 16 ft.; and classed in highest grade in Liverpool Registry, with raised quarter-deck, bridge amid-ships, and topgallant forecastle, and fitted with Higginson's steam-stearing gear and all the latest improvements, to ensure quick dispatch in the loading and in discharging of cargo. As the vessel left the ways she was named the *Newent* by Mrs. Fothergill, of Newcastle, and went direct to Messrs. Dickinson's works to receive her engines.

Mount Tabor.—On June 29th there was launched from the shipbuilding yard of Mr. James Laing, Deptford, Sunderland, an iron screw steamer of 3,300 tons deadweight capacity for Messrs. John Smith & Co., of Glasgow. The vessel was named *Mount Tabor* by Mrs. Maxwell, wife of Captain Maxwell, who takes command. The principal dimensions are:—Length, 285 ft.; breadth, 38 ft.; depth, 27½ ft. The *Mount Tabor* is a spar deck vessel, in excess of Lloyd's requirements for the highest class, has double bottom for water ballast under both holds, and is intended for general trade. The engines, of 36 in. and 68 in. diameter, and 42 in. sroke, will be supplied by Mr. George Clark, of Southwick Works, Sunderland.

Lutka.—On June 29th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend-on-Tyne, an iron screw steamer of the following leading dimensions:—Length, 215 ft.; breadth, 29 ft. 9 in,; depth, 16 ft.; with long full poop, topgallant forecastle for crew, three steam winches, Harfield's patent windlass, and the latest improvements. Her engines are on the compound surface-condensing principle, by Messrs. Black, Hawthorn & Co., and of 110 nominal horse power. The vessel has been built under the personal supervision of Captain Domke, to the order of Th. Rodenacker, Esq., of Dantzic, and is intended for the Mediterranean and Baltic trades. On leaving the ways she was christened the *Lutka* by Mrs. R. Northwanger.

Crœsus.—On June 30th Messrs. Kisch, Boolds, & Co. launched from their yard at Pallion, Sunderland, a screw steamer of the following dimensions:—240 ft. by 34 ft. by 15 ft. 6 in. built under Lloyd's special survey for their 100 A 1 class. She has water ballast throughout on the cellular principle, has long raised quarter-deck, bridge-house and topgallant forecastle, schooner-rigged, accommodation amidships for captain, officers and engineers; four steam winches; Emerson and Walker's patent windlass; Holliday's steam steering gear; large hatchways, and all the latest improvements for the rapid loading and discharging of cargoes. Her engines, of 130 h.p. nominal, built under Lloyd's special survey, will be fitted by Messrs. Carr & Co. (Limited), Sunderland, and will have steam starting, reversing and turning gear, and all the latest improvements in machine engineering. This steamer, the first launched by the firm, has been built to the order of Mr. Thomas Kish & Partners, of Sunderland, and is intended for the Bilbao trade. She is expected to carry 1,750 tons on a light draught of water. On leaving the ways she was named the *Crœsus* by Mrs. Carr, sister of the Managing Owner.

Burns.—On July 1st Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Messrs. Glover Bros., of London. Her principal dimensions are:—Length between perpendiculars, 285 ft.; beam, extreme, 36 ft.; depth, moulded, 25 ft. 2 in.; and she is expected to carry 3,000 tons deadweight. The vessel has topgallant forecastle, long bridgehouse, full poop, double bottom for water ballast in two holds, main deck of iron, and upper deck of wood. She will be fitted with four steam winches, Cochran's patent donkey boiler, patent windlass, and the rig will be that of a double topsail schooner with iron lower masts. The steamer has been built under Lloyd's special survey for the 100 A 1 class to the three-deck rule, and under the inspection of Mr. T. Glover, junr., the Owners' Marine Superintendent. Engines of 180 horse-power will be fitted by Messrs. T. Richardson & Sons, of Hartlepool. As in the case of the previous vessel launched by the firm, steel wire ropes were used for bringing up, in lieu of the usual chain cables. This method bids fair to supersede in a short time the older, more cumbrous, and less safe method of checking the velocity. On leaving the ways the steamer was christened *Burns* by Miss Vick, daughter of one of the builders.

Myrtle.—On the 1st July, there was launched from the shipbuilding yard of Messrs. William Pickersgill & Sons, Southwick, Sunderland, an iron screw steamer of the highest class at Lloyd's, of the following dimensions:—Length, 241 ft.; breadth, 34 ft.; depth of hold, 17 ft. She has been specially designed for trading between the Danube, Azof, Black Sea, and Baltic Ports, where a light draught of water is required. She has a raised quarter-deck, long bridge amidships, and topgallant forecastle, while all her decks are of iron. She will be fitted with four hatchways, four horizontal steam winches, and donkey boiler, Harfield's patent windlass, and anchor crane on the forecastle. The machinery and boilers have been constructed by Mr. George Clark, of Southwick, and under the superintendence of Mr. Gray. The boilers are two in number, and of 80 lbs. pressure. The engines are 140 horse-power nominal, with cylinders 31 in. and 57 in, with 36 in. stroke, The hull, outfit, and machinery have been constructed under Lloyd's special survey, and are of the highest class. She has been built to the order of Messrs. Hopper, Crosby, & Partners, of Sunderland. As the vessel left the ways she was named the *Myrtle*, by Mrs. Watts, wife of the Rev. A. Watts, senior curate of Bishopwearmouth parish.

St. Andrew's Bay.—On July 8rdthere was launched from the shipbuilding-yard of Messrs. Andrew Leslie & Co., of Hebburn Quay, a steamer built to the order of Messrs. Affleck & Gray & Partners, of North Shields, and intended for the Indian, American, and Black Sea trades. The dimensions of the vessel are as follows: - Length, 265 ft. (between perpendiculars); breadth, 35 ft.; depth, 23½ ft. The vessel has a full poop, long bridge, and topgallant forecastle, has been built under special survey, and is classed 100 A 1 at Lloyd's. The carrying capacity of the vessel is 2,700 tons. As the vessel left the ways she was named the *St. Andrew's Bay* by Mrs. C. J. Drummond, of North Shields. The steamer proceeded to Sunderland to receive her engines, which are of 190 horse-power nominal, and built by the North-Eastern Engineering Company.

Earl of Dumfries.—On July 3rd there was launched by Messrs. S. P. Austin & Son, Wear Dockyard, Sunderland, an iron screw-steamer named the *Earl of Dumfries.* She has been built to the order of Messrs. Martin & Marquand, of Cardiff, and is of the following dimensions:—Length over all, 254 ft.; breadth, 36 ft.; depth (moulded), 19 ft. Gross tonnage, about 1,504; nett tonnage, about 970. She is constructed with long raised quarter-deck, bridge and fore-castle, iron decks, and double bottom for water ballast. Classed 100 A 1 at Lloyd's, under special survey. She will be fitted with engines of 140-horse power, with large boilers by Mr. John Dickinson, donkey boiler and 3 steam winches by Messrs. Clarke, Chapman & Gurney, of Gateshead, patent windlass by Messrs. Emerson & Walker, and with all the latest improvements. She is designed to carry largely on a light draught of water. As she left the ways she was named by Mrs. Martin, wife of W. H. Martin, Esq., senior partner.

Bolan.—On July 4th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mor aunt & Co., Southampton, a sailing ship of 2,000 tons nett register, built to the order of Messrs. T. & J. Brocklebank, of Liverpool. Her dimensions are:—Length, 273 ft.; breadth, 40 ft.; depth of hold, 24 ft. She is built with monkey forecastle, long midship house for crew, and full poop aft, with all the latest improvements, including Harfield's patent windlass for working anchors and a steam winch for discharging cargo. She is to take the 100 A 1 class at Lloyd's and 20 years in the Underwriters' Registry. The ceremony of naming the vessel the *Bolan* was performed by Mrs. Campbell, wife of the Captain. The vessel has been inspected while building by Captain Ray, of Liverpool, who is superintendent for the firm, and by Mr. Malcolm.

Oranmore.—On July 4th 'this new steamer, built for Messrs. Johnson & Co., of Liverpool, was launched by the Barrow Shipbuilding Company. Her dimensions are :—Length, 352 ft.; breadth, 40 ft.; depth of hold, 31 ft. 3 in. She will be fitted with compound inverted direct-acting surface-condensing engines, with cylinders 42 in. and 80 in. in diameter, and a stroke of 4 ft. There are two boilers, with twelve furnaces. The *Oranmore* is intended for the general cargo trade.

Milo.—On July 5th, William Gray & Co. launched from their yard an iron screw-steamer of the following dimensions :—Length, 240 ft.; breadth, 32 ft.; depth, 17 ft.; built to the order of Messrs. Leask & Clark, Hartlepool, for general trade, to carry about 1,650 tons. She is fitted with three steam winches, and Emerson & Walker's patent windlass, and has a double bottom in each hold for water ballast. The engines, which are being supplied by Messrs. Blair & Co. (Limited), Stockton, are 120-h.p. On leaving the ways the christening ceremony was performed by Mrs. Clark, wife of Captain R. Clark, one of the managing owners, the vessel being named *Milo.*

Grodno.—On July 6th a steel screw steamer for Messrs. Thomas Wilson, Sons & Co., named the *Grodno*, was launched at Hull from the yard of Earle's Shipbuilding and Engineering Company (Limited). The ceremony of naming the vessel was performed by Miss Mona N. M'Cormick. The vessel is intended for the Mediterranean service. Her dimensions are 270 ft. between perpendiculars, 34 ft. beam, and 18 ft. 3 in. depth of hold, and she is built to class 20 years, Liverpool Registry. Her gross tonnage will be about 1,800 tons, and her deadweight carrying capacity 2,350 tons, and she has raised quarter-deck, long bridge, and top gallant fore castle, all the accommodation for Officers and Crew being above the tonnage deck. She has provision for water ballast in double bottom all fore and aft, and has large hatchways, and especially good facilities for working cargo. The engines, which also have been made by Earle's Company, are 140 nominal horse-power This is one of four steamers of the same type that this company is building for these owners.

Moresby.—On July 8th this vessel, a three-masted ship of 1,200 tons register, was launched from the Whitehaven shipyard. She is 235 ft. long, 36 ft. beam, and 23 ft. depth of hold.

Ancient Briton.—On July 15th there was launched from the yard of the Tyne Iron Shipbuilding Company (Limited), of Willington Quay, a steamer, 225 ft. by 31 ft. by 16 ft., built to the order of Messrs. Gibbs & Lee, of Cardiff, and is fitted with facilities for rapid loading and discharging. The size of the engines will be—Cylinders 28 and 54 in., and stroke 33. Windlass, Emerson Walker & Co's. Patent. The vessel was named the *Ancient Briton.*

Toledo.—On July 15th Messrs. Joseph L. Thompson & Sons launched at Sunderland an iron screw-steamer of over 6,000 tons displacement, to the order of Mr. John Tully, of that town. The vessel is of the spar deck type, and is of the highest classification at Lloyd's. The engines are of 300-horse power nominal, and are being built by Mr. John Dickinson, of Palmer's-hill Engine Works. The naming of the *Toledo* was performed by Miss A. Tully, daughter of the Owner.

Leven Vale.—On July 17th there was launched from the Cleveland Dockyard, Middlesbrough, by Messrs Raylton Dixon & Co., an iron screw steamer, built for J. M. Lennard, Esq., of the same port. This is the fourth steamer Messrs. Dixon have already built for Messrs. Lennard, and she was christened *Leven Vale*, after Mr. Lennard's residence, by Miss Sadler, of Preston-on-Tees. The *Leven Vale* is 245 ft. in length, 33 ft. beam, 17 ft. depth of hold. She is built on the quarter-deck principle, with cabins amidships, and iron wheelhouse aft for protection of steersman. She will carry a deadweight of about 1,600 tons, and her engines, of 100-horse power nominal, will be fitted by Messrs. Blair & Co., of Stockton, who have engined all Messrs. Lennard's steamers.

Preston.—On July 17th Messrs. William Gray & Co. launched from their yard, at West Hartlepool, an iron screw steamer of the following dimensions :—Length, 300 ft.; breadth, 40 ft.; depth of hold to upper deck from top of floors, 24 ft. 6 in. She is classed 100 A 1 at Lloyd's, and built to the order of Messrs. R. Ropner & Co., of West Hartlepool, under special survey of Captain B. Rooke. This vessel is intended for the Indian trade, to carry 3,300 tons. She is fitted with all recent improvements, including Davis's steam steering gear amidships, four steam winches by Clark, Chapman & Gurney, direct acting steam windlass by Emerson & Walker, and two vertical donkey boilers. Her engines, of 300 horse power, are to be supplied by Messrs. Thomas Richardson & Son, of Hartlepool, with two double-ended boilers at 85 lbs. pressure. This vessel is built on the upper deck rule, having long bridge and forecastle, with two complete iron decks all fore and aft, extra iron bulkheads over Lloyd's rules, double bottom on M'Intyre's principle, divided into four tanks, shifting boards fitted complete throughout, and two lighthouses fitted on forecastle for side lights. On leaving the ways she was christened the *Preston* by Miss Mabel Ropner, daughter of the owner.

Olympia.—On July 17th Messrs. M. Pearse & Co. launched from their iron shipbuiling yard at Stockton an iron screw steamer of the following dimensions :—Length between perpendiculars, 300 ft.; breadth moulded, 40 ft.; depth, 26 ft. The vessel is built to the order of Mr. F. Hirskind, of West Hartlepool, and is about 2,600 tons gross register, and will carry about 3,800 tons deadweight. She is built on the three-decked rule, having two decks laid, and will obtain the highest class at Lloyd's under their special survey, and also under the inspection of the Owner's Marine Superintendent, Mr. J. R. Fothergill. She has a short full poop aft, bridge-house amidships, and T.G.F. She will be rigged as a two-masted brigantine, having double topsails on her foremast. She will be provided with engines on the direct-acting surface-condensing principle, of 250 h.p. nominal, 42 in. and 77 in. by 48 in. stroke, from the well-known establishment of Messrs. Blair & Co., of Stockton, four steam winches, steam stearing gear, patent capstan windlass by Emerson, Walker, & Co., London, has double bottom for water ballast on the cellular principle, and all the most recent and improved appliances for expeditiously loading and discharging cargoes. As she left the ways she received the name of *Olympia.*

Llandaff City.—On July 17th, Messrs. Richardson, Duck, & Co. launched from their South Stockton iron ship yard this iron screw steamer of the following dimensions :—Length over all, 276 ft. 6 in.; ditto between perpendiculars, 270 ft.; breadth, extreme, 36 ft.; depth in hold, 23 ft. 6 in.; tonnage, gross, about 1940. The steamer has been built to the order of Messrs. Charles Hill & Sons, of Bristol and Cardiff, and is the seventh by the above firm for the same owners. Her patent windlass has been supplied by Messrs. Emerson, Walker, & Co., London; engines, by Messrs. T. Richardson, & Sons., Hartlepool, are 180 horse-power, on the compound direct acting principle, cylinder 36 in. by 67 in. diameter, 86 in. stroke, pressure of steam 75 lb.

Leader.—On July 18th there was launched from the yard of Messrs. Bartram & Haswell, South Dock, Sunderland, an iron screw steamer, being the first vessel built to the order of the North Durham Steam Shipping Company (Limited), of which Messrs. Hodgson & Egglestone, of Sunderland, are the Managing Owners. Her dimensions are as follow :—Length, 260 ft.; breadth, 36 ft.; depth of hold, 18½ ft.; with a carrying capacity of about 2,200 tons. She has a long raised quarter, extra bulk-heads, bridge over engines, a poop over aft, and a topgallant forecastle for the accommodation of the crew. She will be engined by Mr. John Dickinson, of Sunderland, with a pair of 150 horse-power compound engines, and has been built under special survey to class 100 A in Lloyd's, and is intended for the Indian and Mediterranean trade. The vessel will be fitted with steam winches and all the most improved modern appliances, and is a sister ship to the *Palm Branch.* As she left the ways she was named the *Leader* by Mrs. George Forman.

Sailor Prince.—There was launched on July 18th from the yard of Messrs. Hodgson & Soulsby, the *Sailor Prince*, iron steamer of 1,230 tons. Her measurements are as follows :—Length, 242 ft.; breadth, 33 ft.; depth, 16 ft. 5 in. She has been built to the order of Mr. James Knott, of Newcastle, and has inverted direct acting compound screw engines of 29 in. and 55 in. by 36 in., and 125 nominal horse power, manufactured by Messrs. Black, Hawthorn & Co., Gateshead.

Donau.—On July 18th Messrs. Robert Thompson & Sons launched from their shipbuilding-yard, at Southwick, Sunderland, an iron screw steamer of the following dimensions :—Length, 249 ft.; breadth, 35 ft.; depth to floor, 17 ft. She has been built for Messrs. Mohr & Son, Bergen, under Lloyd's special survey (for the highest class), and under the personal superintendence of Captain Müller, who will command her. The vessel has been constructed to carry a large cargo on very small draught, and has long full poop extending over the engine and boilerspace, with large cabin aft for Captain and passengers, and accommodation under the bridge for engineers and officers. The topgallant-forecastle is fitted up for the crew and firemen. She is schooner-rigged, and has three large hatchways, large side ports for discharging cargo, &c., and has ample water ballast. She has also a large donkey boiler and three steam winches by Messrs. R. Roger & Co., Stockton: Emerson, Walker & Co.'s patent windlass. &c. The engines, which are of 130-horse-power, will be fitted by Mr. John Dickinson, Sunderland. As the steamer left the ways she was named the *Donau*, by Miss Maud Thompson, of Sunderland.

Mameluke.—On July 18th there was launched from the building-yard of Messrs. C. Mitchell & Co., Low Walker, an iron screw steamer, built to the order of the Bedouin Steam Navigation Company, of Liverpool. The vessel is fitted with Messrs. Emerson, Walker & Co's patent direct steam windlass, is intended as a general trader, and was named the *Mameluke*. The steamer, which is of 4,000 tons burthen, is built to the highest class at Lloyd's, and has all the most modern appliances of a first-class cargo steamer.

LAUNCHES—SCOTCH.

Matterhorn.—On June 22nd Messrs. Russell & Co.. Greenock, launched from their yard a four-masted iron sailing vessel of 1,850 tons. Dimensions;—257 ft. long; 40 broad; and 23 ft. 9 in. deep. The vessel, which has been built to the order of Mr. De Wolff, of Liverpool, was named the *Matterhorn*, When completed she is to be loaded at Liverpool for San Francisco.

Maracas.—On June 22nd Messrs. M'Millan & Son launched from their dockyard at Greenock, a double-bottomed iron sailing ship of 1,705 tons, B.M. The new ship was named *Maracas*, and has been built to the order of Messrs. William Kenneth & Co., of Glasgow. The double-bottom will contain 300 tons weight of water, and is divided into three compartments arranged to suit the trimming of the ship under almost all circumstances. Very powerful pumps are fitted to each compartment, capable of pumping out the whole 300 tons in about three hours. She is also fitted with two powerful steam winches, donkey boiler and condenser, and has iron lighthouses fitted on each side of the forecastle, accessible from underneath, and thus avoiding much personal risk in heavy weather. The ceremony of naming the vessel was performed by Mrs. Kenneth, Lca Bank, Dumbartonshire.

Sylvia.—On June 22nd there was launched at Linthouse a steam yacht, built by Messrs. Alexander Stephen & Sons for the senior partner of that firm, Mr. Alexander Stephen, Lord Dean of Guild, and the vessel was named the *Sylvia* by Mrs. Stephen. The *Sylvia's* dimensions are:—Length over all, 143 ft.; breadth, 18 ft.; depth moulded, 10 ft. 10 in.; yacht measurement, 185 tons. The engines (also made at Linthouse) are of 60 horse-power nominal, and, being fitted on board complete, the vessel was launched with steam up, and immediately after proceeded down the river. The vessel is schooner-rigged, and built in excess of Lloyd's requirements for the highest class. The deck-house, saloon, state-rooms, &c., are placed before the engines, the accommodation for officers and crew being aft.

Orpheus.—On June 23rd the Campbeltown Shipbuilding Company launched a steamer of about 500 tons burthen, her dimensions being 155 by 24 by 11. The steamer is built to the order of Messrs. Robert Gilchrist & Co., Liverpool, and is intended for the coasting trade. She is built to the highest class of Lloyd's, under special survey, and has every facility for speedy loading and discharging cargo, being fitted with steam cranes winches, &c. As the vessel left the ways she was named the *Orpheus* by Miss Melville, of Campbeltown. The vessel is to be fitted with a pair of compound surface-condensing engines by Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow.

Clyde.—On June 23rd a new screw dredger of 800 tons, built and engined by Messrs. W. Simons & Co., was launched complete from their works at Renfrew. It is named *Clyde*, and is the property of the Clyde Lighthouse Trust, having been built under the direction of their engineers, Messrs. D. & T. Stevenson, Edinburgh. This is the third Dredger this firm have constructed for the River Clyde, and will be the most powerful, being fitted with compound engines of 350 horse-power, and is designed to raise 500 tons per hour from a depth of 35 to 40 feet of water. On board are steam appliances for head, stern, and side movements, also for lifting, lowering, and manœuvring; and throughout the hull and machinery every recent improvement has been adopted.

Normandy.—On June 29th Messrs. John Elder & Co. launched from their Fairfield Works, Govan, the steel paddle steamship *Normandy*, sister ship to the *Brittany*, which was launched May 31st, both constructed by that firm for the London, Brighton, and South Coast Railway Co., and the Western of France Railway Co. The *Normandy* is similar to, though somewhat larger than the Victoria and Brighton, built by Messrs. J. Elder & Co. for the same companies about three years ago, and which proved very successful vessels in every way. The principal dimensions of the *Normandy* are:—Length, 230 ft.; breadth, 27 ft. 6 in.; depth, (moulded), 11 ft. 8 in.; tonnage (gross), about 600 tons. The engines are of the diagonal compound type, with high-pressure cylinder, of 46 in. diameter and low-pressure cylinder of 88 in. diameter by 5 ft. stroke, and the steam is supplied at a pressure of 100 lbs. by four steel boilers. The indicated horse power will be above 2,200, and this will give a speed of about 17½ knots per hour. The vessel will be fitted up for 100 first-class and 70 second class passengers, with every convenience necessary for the Channel passage, including electric light, electric bells, and steam-heating pipes in all cabins. The ventilation has also been specially studied. The usual steam apparatus for steering, lifting the anchor, pumping out vessel, &c., is fitted. As the vessel left the ways, she was named the *Normandy* by Mrs. Stroudley, of Brighton.

Wuchang.—On June 30th Messrs. Scott & Co., Shipbuilders, Greenock, launched from their shipbuilding-yard at Cartsdyke a twin screw steamer of 1,250 tons register, and of the following dimensions:—Length, 250 ft.; breadth, 32 ft.; and depth, 21 ft. The steamer has been built to the order of Messrs. Swire & Sons, Shipowners, London, and is intended for the China trade. On leaving the ways she was named the *Wuchang*, by Mrs. J. S. Swire, wife of the owner. The *Wuchang* is sister steamer to the *Chung King*, recently launched by the same firm for Messrs. Swire & Sons.

Sarnia.—On June 30th Messrs. Charles Connell & Co., launched from their shipbuilding yard at Scotstoun an iron screw-steamer of 3,850 tons, built to the order of Messrs. Flinn, Main, & Montgomery, Liverpool, for the Mississippi and Dominion Steamship Company (Limited). As she left the ways she was named *Sarnia*, by Mrs. J. R. Montgomery, of Liverpool, and was immediately taken to the Finnieston crane to have her machinery fitted on board, which is being supplied by Messrs. John & James Thomson, Finnieston Engine Works. The *Sarnia* is built to class 100 A 1 at Lloyd's with a number of extras beyond the requirements for the highest class, and is fitted up with every facility for the rapid loading and discharging of cargo. Accommodation is provided for a large number of first-class, intermediate, and steerage passengers.

Hermes.—On June 30th Messrs. Aitken & Mansel launched from their yard, at Whiteinch, a screw-steamer, of about 2,500 tons gross, for Messrs R. P. Houston & Co., of Liverpool, which will be employed by them in their general carrying trade. This vessel, which is named the *Hermes*, will be towed to Liverpool, and will be fitted there with her machinery by Messrs. John Jones & Sons, engineers, Liverpool. The vessel has been completed under the supervision of Captain Taylor, her Commander.

Loch Bredan.—On July 1st Messrs. Dobie & Co. launched from the Govan Shipbuilding-yard an iron sailing barque, built for the Loch Line of Mr. James Sproat, of Liverpool. This vessel, which is the seventh the builders have constructed from the same model, measures about 1.000 tons gross, and is classed 100 A1 at Lloyd's, As the vessel left the ways she was named *Loch Bredan* by Mrs. James Conning, of Kirkcudbright. The *Loch Bredan* proceeds to load for Sydney, under the command of Captain Cumming.

Cedric.—On July 1st there was launched from the shipbuilding-yard of Messrs. Murdoch and Murray, Port Glasgow, a screw steamer of about 2,000 tons, built to the order of Messrs. George Hood & Co., Glasgow, for their Black Sea trade. This steamer has been built to the highest class at Lloyd's, and possesses all the latest improvements in hull and machinery. Her engines, which are of 150 horse power nominal, will be supplied by Messrs. Muir & Houston, of Glasgow. On leaving the ways the steamer was named the *Cedric*, the ceremony being performed by Mrs. Kirkman J. Finlay, of Abergwynant, and Eaton-gardens, Brighton.

Cholon.—On July 3rd there was launched from the shipbuilding yard of Messrs. A & J. Inglis, Pointhouse, an iron screw steamer of 3,000 tons for the Compagnie Nationale de Navigation, Marseilles. As the vessel left the ways she was named *Cholon* by Mrs. J. C. Bush, New York, United States, and immediately thereafter was towed to the builders' crane to take in machinery.

Werra.—On July 4th Messrs. John Elder & Co. launched rom their shipbuilding yard at Fairfield, Govan, an iron screw steamship of 5,100 tons gross register for the North German Lloyds Company, of Bremen. This vessel, which is intended for the Bremen and New York line, is of the following dimensions:—Length, 450 ft.; breadth, 46 ft.; depth, 36 ft. 6 in. She is classed the highest grade of the Bureau Veritas, with several extras over their requirements, such as iron, lower, and orlop decks, and additional water-tight bulk-heads. The upper deck is of teak. All the deck-houses and deck work, it may also be stated, are either of teak or iron. To protect the vessel from the heavy Atlantic seas, strongly constructed iron turtle decks are placed at both ends of the ship. In the centre part of the upper deck there are houses for the Officers, Firemen, &c., together with galleys, smoking-room, entrances to first and second saloons, &c. Over this there is a promenade deck about 180 ft. long, and the whole width of the vessel solely appropriated to the use of the first-class passengers. Besides this accommodation for the ship's officers and crew—170 in number—the vessel will carry 170 first-class, and 90 second-class 1,100 third-class passengers. The steerage passengers are berthed on the lower deck, while the first and second-class passengers are located on the main deck, the chief saloon being placed forward of the engines and boilers. The vessel is rigged with four pole-masts of iron, with yards on the fore and main masts. She is provided with steam windlass, steam and hand steering gear, steam winches, steam hold pumps, steam navy pumps, fresh water condenser, and, in fact, all modern appliances to ensure the safety of the vessel at sea, and to facilitate the working of cargo. The vessel will be propelled by compound engines of the inverted cylinder type, supplied by the builders, having two low-pressure cylinders 86 in. diameter, and one high-pressure cylinder of 62 in. diameter, 5 ft. stroke, and working up to 95 lbs. pressure. Steam is supplied by four double-ended boilers, and six furnaces in each, and it is fully expected that the engines will develop 6,000-horse power. As the vessel left the ways she was named the *Werra* by Miss Frost, of London.

Poo-Chi.—On July 4th Messrs. Aitken & Mansel launched from their yard at Whiteinch a twin-screw steamer of 800 tons gross register. This vessel, which received the name *Poo Chi* from Mrs. James Weir, is constructed of Siemens steel, and has been built to the order af Messrs. George & James Weir, for the China Merchant Steam Navigation Company. The machinery will be fitted by Messrs. Lees, Anderson, & Co., Glasgow.

Cumbrae and *Cloch.*—On July 4th two duplicate new iron screw steamers, each of 500 tons capacity, built and engined by Messrs. W. Simons & Co., were launched complete from their works at Renfrew. They are fitted with compound engines of 100 horse-power, and are named respectively *Cumbrae* and *Cloch*. These steamers are the property of the Clyde Lighthouse Trust, and are intended for the deepening operations on the Clyde, under the supervision of their engineers, Messrs. D. & T. Stevenson.

Lonsdale.—On July 12th Messrs. Robert Steele & Co. launched from their shipbuilding-yard at Greenock a paddle steamer, built to the order of Captain James Deane, of Melbourne, for the passenger trade at Port Philip Bay. The steamer is built of steel, under special survey at Lloyd's, and her construction has been superintended by J. F. Spencer, Esq., C.E., London. Her dimensions are as follow:—Length, 200 ft.; breadth, 25 ft.; and depth, 11 ft. 6 in. On leaving the ways she was named the *Lonsdale* by Miss Steele, daughter of one of the builders. The engines, supplied by the firm, are on the compound disconnecting diagonal principle, and are of sufficient power to drive the vessel at a high rate of speed. After the launch the new steamer was towed to the East India Harbour, where the utmost despatch will be used in having her fitted out and made ready for the passenger trade at Melbourne.

Cheribon.—On July 15th Messrs. Wm. Denny & Bros. launched from Levan shipyard, Dumbarton, an iron screw steamer of about 3,060 tons gross measurement for the Compagnie Nationale de Navigation of Marseilles. On leaving the ways she was named the *Cheribon*, by Mrs. James Campbell White, of Crosslet. The dimensions of the vessel are:—Length between perpendiculars, 340 ft. moulded; breadth moulded, 40 ft.; depth moulded, 30 ft. She has been built in accordance with the rules of the Bureau Veritas for the highest class, and will have accommodation for 24 first-class and 24 second class passengers. She will be fitted by Messrs. Denny & Co. with compound surface-condensing engines of about 2,000 indicated horse-power, the cylinders being 72 in. and 41 in. diameter, and length of stroke 51 in. While being constructed the vessel has been under the inspection of M. Roudet, the Superintending Engineer of the company. The *Cheribon* is a duplicate of the *Chandernagor*, built by the Messrs. Denny for the same company and launched on the 6th ult.

Hudson Bay.—On July 19th Messrs. Russell & Co. launched at Port Glasgow an iron ship called the *Hudson Bay*, her dimensions being:—Length, 258 ft.; breadth of beam, 38 ft.; depth of hold, 22 ft. 9 in.; of 1,580 tons register. The owners are Messrs. Hatfield, Cameron, & Co., Glasgow. The new ship is fitted up with Messrs. Emerson & Walker's patent windlass, and Messrs. R. C. Wallace & Co.'s patent pumps. After fitting out she will proceed to Glasgow and load for Rangoon. Captain Vesey is in command. This is the fourth ship built by Messrs. Russell & Co. from the same model, and the second for this firm.

Umsim Kulu.—On July 19th there was launched from the Abercorn Shipbuilding-yard, Paisley, a screw steamer capable of carrying about 200 tons on a draught of six feet. Dimensions:—122 ft. long between perpendiculars, by 22 ft. beam, to be propelled by a pair of compound surface-condensing engines of 150 indicated horse-power, supplied by Messrs. Hannah, Donald, & Wilson. The vessel was named the *Umsim Kulu*, by Miss Clazy. The vessel has been built to the order of Messrs. Pollok, Clazy, & Co., of Glasgow, Durban, Natal, and East London, South Africa.

LAUNCHES.—IRISH.

Walter H. Wilson.—On July 6th a large sailing vessel was launched from the shipbuilding yard of Messrs. Halland, Wolff, & Co., of Belfast. She is named the *Walter H. Wilson*, after one of the partners of the firm of builders, and is for Mr. Samuel Lawther, J.P., Belfast. Her measurement is 300 ft. by 42½ ft. by 25 ft. She will be classed 100 A at Lloyd's. She is built of iron, has four masts, three of which are square rigged, and is capable of carrying 4,000 tons deadweight.

Newhaven.—On July 19th there was launched from the shipbuilding yard of Messrs. Workman, Clark, & Co. (Limited), Belfast, a screw steamer, of 1,000 tons burthen, built to the order of Messrs. R. Mackie & Co., Leith. Her principal dimensions are:—Length, 201 ft.; breadth, 31 ft. 6 in.; depth of hold, 14 ft. The steamer has been built with all the latest improvements, and will be supplied with machinery by Messrs. Lees, Anderson, & Co., Glasgow. On leaving the ways she was named the *Newhaven* by Mrs. Mackie, wife of the Managing Owner. The construction of the steamer has been superintended by Mr. David Marshall, marine engineer, Edinburgh.

LAUNCH.—GERMAN.

Glucksburg.—There was launched on the 26th June from the yard of the Flensburg Iron Shipbuilding Co., to the order of the Globus Co., a new screw steamer of the following dimensions:—Length B P, 235 ft.; breadth moulded, 32 ft. 10 in.; depth of hold, 16 ft. 6 in.; with a carrying capacity of about 1,800 tons, cargo and bunkers. She is built to the 1st division Bureau Veritas. Her engines will be of 150 nominal horse power. As she left the ways she was gracefully christened *Glucksburg* by Miss Toosbuy. The most distinguished of the many ladies and gentlemen present to witness the launch was his Excellence, Sir Puttkamer, attended by many gentlemen of rank. After the launch was over a number of ladies and gentlemen retired to a large room prepared for the occasion, and there drank success to the *Glucksburg* in champagne. In about four weeks she will proceed on her way to China, and will there engage in the China trade, for which trade she has been especially built.

LAUNCHES.—SWEDISH.

Spinosa.—On July 20th there was launched from the Motala Company's yard, at Lindholmen, near Gothenburg, a twin-screw steamer built throughout of Motala Bessemer steel, and in every respect like *Sokrates*, a sister ship launched in June last. The *Spincza* is of the following dimensions:—Length, 252 ft.; breadth moulded, 28½ ft.; depth of hold, 15¼ ft. She is intended for carrying petroleum in bulk. The engines, a pair of compound surface-condensing of 50 nominal horse power each, will at once be erected in the ship.

TRIAL TRIPS.

Warwick.—On June 24th the new steel screw steamer *Warwick* recently launched by Wigham Richardson & Co., proceeded to sea, and, after adjusting compasses and making a short run, started on her voyage to Bristol to complete her loading for New York. The engines worked throughout without a single hitch, and gave the greatest satisfaction to all concerned. The *Warwick* is under the command of Captain Lobbitt, late of the *Devon*, belonging to the same owners, the Great Western Steamship Company.

Clan Mackensie.—On June 24th the *Clan Mackenzie*, which was launched about eight weeks ago from Messrs. Ramage & Ferguson's shipbuilding yard at Leith, went out on her trial trip on the Firth of Forth with most satisfactory results. The *Clan Mackensie* is the largest steamer ever built on the Forth, being 3,000 tons gross register, with a dead weight carrying capacity of over 4,000 tons.

Gwenllian Thomas.—On June 24th the new screw steamer *Gwenllian Thomas*, built by Palmer's Shipbuilding and Iron Company (Limited) at Shields, for Mr. Evans Thomas & Partners, Porthcawl, Glamorganshire, had a successful trial trip at sea. The dimensions of the vessel are: Length, 235 ft.; breadth, 31 ft.; depth, 18 feet; carrying capacity, deadweight, 1,650 tons. She is classed 100 A1 at Lloyd's. Her cylinders are respectively 28 in. and 52 in. in diameter, and the piston stroke is 33 in. With 80 lbs. of steam and 27 vacuum, the engines went at the rate of 80 revolutions. The vessel subsequently returned to the Tyne, everything during the trip having passed off most satisfactorily.

The Romania.—The new steamer *Romania*, the first built to the order of the Romania Steamship Company, managed by Messrs. Thomas Russell & Son, ran a most successful trial trip from the Tyne on June 25th. The Romania was built by Messrs. W. Pickersgill & Sons, of Southwick, Sunderland, and engined by Mr. George Clark, of the Southwick Engine Works. Her dimensions are: 235 ft. long, 33 ft. 6 in. beam, 16 ft. 2 in. depth of hold, 1,250 tons register, and carrying capacity of 1,750 tons, whilst the most improved machinery necessary for a cargo steamer has been provided. Her engines, which are on the compound surface condensing principle, have cylinders 29½ in. and 55 in. diameter respectively, and 36 in. stroke, and during the trial ran 90 revolutions, developing 960-horse power, and a mean speed of 10½ knots.

Essex.—On June 29th the *Essex*, steamer, which has recently been built by Messrs. Raylton Dixon & Co., to the order of Messrs. Money, Wigram & Sons, Limited, of London, for their Australian line of steamers, proceeded on her trial trip from Middlesbrough. She is an iron screw steamer of the following dimensions: Length over all, 310 ft.; breadth, 40 ft.; depth of hold, 25 ft. 3 in.; and has a large carrying capacity of 3,700 tons. She is built on the three-deck rule, having iron main deck and upper deck covered with teak, poop, long bridge, and forecastle, steam steering gear, extra steam winches, and is intended principally for cargo carrying, but having some accommodation in the poop for a few passengers. Her engines of 250-horse power nominal, by Messrs. T. Richardson & Sons, of West Hartlepool, indicating up to 1,550-horse power, worked remarkably well, giving a speed of 12¾ knots. After a successful run to the north, she landed some of her passengers and proceeded to London, where she will load direct for Australia.

Juno.—On July 1st the Wilson liner *Juno*, built by Earle's Shipbuilding and Engineering Company, Hull, was taken out to sea for a trial of her speed and working. This vessel, which is the latest completed addition to the Wilson Line, has been built for the passenger trade between Hull and Hamburg, and to meet the requirements of the service. She has been supplied with powerful engines. The *Juno* was taken out of the Victoria Dock, and her compasses having been adjusted, she went down on the ebb tide at such a speed that in an hour she passed Grimsby. On arriving off the New Sand Lightship she was put away northward for the measured mile off Withernsea. Her speed was here tested by several runs, which gave a mean in her unfavourable trim of 12½ knots. The *Juno* has accommodation for 20 first-class passengers, and, should it hereafter be required, 40 passengers could be provided for. There is also a second-class cabin on the 'tween decks, and accommodation for 200 emigrants has been provided. The fittings are movable, and, should the trade require it, 400 emigrants can be provided for. The engines on the trial trip worked most satisfactorily, making 72 revolutions per minute, without the least sign of heated bearings or priming, the indicated horse power being 1,300. The *Juno* leaves on her first voyage under the command of Captain Bee.

Lucero.—On July 1st the new screw steamer *Lucero*, built by Messrs. Osborne & Graham, of Hoylton, to the order of Messrs. Pecket & Thompson (and resold to Messrs. Carranza & Co., of Bilbao), was taken upon a trial trip which proved eminently satisfactory. The dimensions of the vessel are as follows:—Length, 250 ft.; beam, 35 ft.; depth of hold, 19 ft. The engines were built by Messrs. J. W. & F. Wilson, under the inspection of Mr. Scott, of North Shields, who expressed himself thoroughly satisfied with them, as did also the Owners. The engines were fitted with steam reversing and turning gear and all the latest improvements, andwere of 140-horse power nominal. The cylinders were 32 in. and 60 in. in diameter by 39 in. stroke. There were two boilers of 80 lbs. working pressure. The *Lucero* is fitted with steam steering gear by Mr. Nicholas Taylor, of Monkwearmouth. The compasses having been adjusted, the speed was tried by the log, and it was found that a speed at the rate of 10½ knots per hour was attained. This was deemed highly satisfactory, considering the great capacity of the vessel. Towards evening the *Lucero*, which is intended for the Bilbao trade, entered the Tyne for the purpose of receiving her cargo.

China.—On July 3rd the mail steamer *China* had her trial trip from the Tyne, when the satisfactory result of 13½ knots, upon a draught of 22½ ft., was obtained.

Teviotdale.—On July 5th this steamer, built by Messrs. Robert Steele & Co., Greenock, for Messrs. Robert Mackill & Co., Glasgow, went down the Clyde on her trial trip. The vessel is about 1,600 tons gross and 1,000 tons nett register, and has engines of 165-h.p. nominal. The speed obtained in running the measured mile was at the rate of 11½ knots per hour, the engines working very satisfactorily.

Stratheden.—On July 7th the official trip of the screw steamer *Stratheden* took place on the Clyde. The *Stratheden* was built by Messrs. Henry Murray & Co., of Sandpoint Shipbuilding-yard, Dumbarton, for Messrs. James Hay & Sons, of Glasgow, and the first vessel which the Messrs. Murray have launched since the transference of their business from Port Glasgow to Dumbarton. The *Stratheden* is a vessel of 1,400 tons gross, and is of the following dimensions:—Length, 283 ft.; breadth, 38 ft.; and depth, 16 ft. She has been supplied by Messrs. Fleming & Ferguson, of Paisley, with compound vertical direct-acting engines of 200 h.-p. nominal, and 1,230 indicated horse-power. Her cylinders are 34 and 36 in. diameter, with a stroke of 39 in., to work up to 80 lbs. pressure to the square inch. A specially interesting feature of the trial was the fact that the *Stratheden* has been fitted up with Kunstadter's patent screw-steering apparatus, this being the first vessel built in Scotland which has been so fitted. As soon as the company was on board, the *Stratheden* proceeded to run the measured mile at Skelmorlie. Four trials of the mile were made in all, and the average speed attained was at the rate of 11¼ knots per hour, with the engines giving 78 revolutions per minute. At a previous trial, before the patent rudder-screw was attached, the average speed attained was 9·88 knots, with a draught of 8 ft. 1 in. After the measured mile had been run the new steering apparatus was thoroughly tested, and with the most satisfactory results. The steamer made two double evolutions with the engines going ahead, and one evolution with the engines going astern, and she was turned in about 2½ lengths.

The Admiral Rooke (s).—On the 10th July the trial trip of this steamer took place from Middlesborough to the Tyne, with the very satisfactory result as shown below. This steamer is the first of two built by Messrs. Raylton Dixon & Co. for Messrs. Smith, Imossi, & Co., of Gibraltar, and to be principally employed in the coal trade of that port, being also notable as the first steamship owned in Gibraltar. Her dimensions are:—Length overall, 250 ft.; breadth, 34 ft.; depth of hold to floors, 17 ft.; and she will carry over 1,800 tons deadweight. She is built on the quarter-deck system, having water ballast in both holds, bridge amidships, topgallant forecastle, and hood aft, with cabins below deck, steam steering gear and winches, platforms for discharging coal into hulks, and everything required for vessels of this class. She is fitted with engines of 130 horse-power nominal, by Messrs. Blair & Co. (Limited), of Stockton, having cylinders 31 and 58 diameter, and 36 stroke, large boiler with 80 lbs. pressure, which gave a result of over 11 knots speed on trial trip on her run from Middlesbrough to the Tyne, where she will load in the Tyne dock her first cargo for Huelva, in Spain. She will be commanded by Captain Carlton, of South Shields. These ships have been built under the superintendence of Captain Page, for Messrs. Galbraith, Pembroke, & Co., and the engines inspected by Mr. Charters, for the same firm.

Brittany.—On July 13 the steel paddle steamship *Brittany*, built by Messrs. John Elder & Co. for the London, Brighton, & South Coast Railway Company, and the Western of France Railway Company, for the service between Newhaven and Dieppe, went down the Firth of Clyde on her trial trip before proceeding to her station. The new vessel is similar to, though somewhat larger than, the *Victoria* and *Brighton*, built by Messrs. Elder for the same companies about three years ago. The principal dimensions of the *Brittany* are:—Length, 230 ft.; breadth, 27 ft. 6 in.; depth, moulded, 11 ft. 8 in.; tonnage gross, about 600 tons. The engines are of the diagonal compound type, with high pressure cylinder of 46 in. diameter and low-pressure cylinder of 83 in. diameter, by 5 ft. stroke, and the steam is supplied at a pressure of 100 lbs. by four steel boilers. The vessel is very handsomely fitted up for 100 first-class passengers and 70 second-class passengers, with every convenience necessary for the Channel passage, including electric light, electric bells, and steam-heating pipes in all cabins. The ventilation has also been specially studied. In reference to the electric lighting, it is supplied by Faure's accumulators, and arranged with Edison lamps. The distance between Newhaven and Dieppe is 64 knots, and the new vessel is expected to accomplish it regularly under four hours. Immediately after getting under weigh the *Brittany* ran the lights (Cloch to Cumbrae) in a very heavy sea, with the wind, which was blowing from the south, right ahead, at the rate of 16½ knots, and returned the same distance against a strong tide, but with the breeze in her favour, at 17·448 knots, or fully 20 land miles per hour. The engines developed 2,392 horse-power, and the revolutions attained per minute amounted to 43·5. This was considered highly satisfactory.

The St. Olaf.—On the 21st Julythe new iron screw steamer *St. Olaf* ran her trial trip. She left Port Glasgow early in the forenoon, and steamed down the Clyde. Her speed in running the measured mile was at the rate of 10½ knots an hour, with which the company were well satisfied. The *St. Olaf* was built by Messrs. Murdoch and Murray for the North of Scotland and Orkney and Shetland Steam Navigation Company, and is a vessel of 130 ft. in length. Her engines, supplied by Messrs. Dunsmuir and Jackson, have cylinders of 20 in. and 38 in. respectively, with 90 lbs. pressure. She is to run between Scrabster Pier and Stromness, carrying passengers and the mails. Captain Nicholson is in command.

Maipo.—On July 4 this vessel, the latest addition to the fleet of steamers owned by the Compania Sud-Americana de Vapores en el Pacifico, built by Messrs. John Reid and Co., Port Glasgow, the engines by the firm of Messrs. Rankin and Blackmore, Greenock, went on her trial trip. The *Maipo* is a four-decked vessel rigged as a three masted schooner, 350 ft. long, 41 ft. 6 in. in breadth, and 36 ft. in depth to shade deck, her gross tonnage being 3,000 tons. The engines are 280 horse-power nominal, 45 and 80, with 4 ft. 8 in. stroke, having a working power equal to 2,400, with 90 lbs. pressure. Four of Fox's corrugated flue boilers supply the steam, which proved ample. There are besides three donkey engines in the engine-room, &c. At the trial trip the engines worked with great smoothness and minimum vibration, the speed obtained being equal to 14½ knots.

Glenworth.—On July 7th this new screw steamer, built by Messrs. Key & Son, at Kinghorn, for the Australian Steam Navigation Company. Sydney, made her official trial trip. The vessel steamed for Inchkeith, and ran between there and Mickrie, a distance of five miles, making an average speed of 13 knots an hour, being one-half knot above the builders' guarantee. The vessel was next headed for May Island, and the run there of thirty-five miles, at easy speed, was accomplished at the rate of 13 knots an hour. During the whole day the engines of the vessel worked most satisfactorily, not one drop of water being required for any of her bearings. The average horse-power developed was 1,080, with a consumption of coal equal to 22 tons per day.

Countess Evelyn.—This vessel, built to the order of Mr. James Ware, of Cardiff, by Messrs. Caird & Purdie, of Barrow-in-Furness, was taken out for her trial trip on July 10th, when most satisfactory results were obtained; the vessel in ballast trim steaming 10½ knots, with screw only partially immersed. The engines, made by Messrs. Westray, Copeland, & Co, Barrow, are 30 and 55 in. diameter of cylinders and 36 in. stroke, and worked most satisfactorily, steam being easily maintained. The vessel has been built expressly for the Bilboa ore trade, and is fitted with every appliance for the rapid discharge of cargo. Her dimensions are 245 by 34 by 15·6 to top of cellular water, ballast tanks which contain 280 tons, and her gross register tonnage is 1,354 tons. It is confidently expected this vessel will steam easily 10 knots when loaded. She takes highest class at Lloyd's, and was built under the superintendence of Mr. C. M. Jacobs, of Cardiff.

Minard Castle.—On July 12th this steamer lately launched by Messrs. John Fullarton & Co., Merksworth Building-yard, Paisley, for the Lochfyne and Glasgow Steam Packet Company (Limited), went down the river on her official trial trip. A speed of 12 knots was attained, which was considered highly satisfactory. The engines, which were fitted in by Mr. William Kemp, engineer, Gowan, worked with the greatest smoothness.

Wairapa.—On July 14th this screw steamer, built by Messrs. Wm. Denny & Bros., and engined by Messrs. Denny & Co., for the Union Steamship Company of New Zealand, went down the river on her trial trip. The *Wairapa* is a vessel 1,900 tons gross, and built of steel. Her engines are inverted, direct-acting, surface-condensing, of 300 horse-power nominal. The vessel on the measured mile attained a mean speed of 14 knots per hour.

TRIAL TRIP.—DUTCH.

Zaandam.—On July 20th the screw steamer *Zaandam*, built and engined by the Netherland Steamboat Company to the order of the Netherland American Steam Navigation Company, left the Fyenoord yard for Amsterdam. The principal dimensions are:—Length, 328 ft.; breadth, 39 ft.; load draught, 23 ft. 8 in. Gross register tonnage, 3,070; nett ditto, 2,282. The engines are inverted compound surface condensing, 43 in. and 76 in. cylinder diameters and 4 ft. stroke; 70 lbs. pressure of steam. The ship was ordered some 14 months ago, and launched in the beginning of May. She was got along the quay and under the crane for putting her machinery in on the 24th of May. The trial trip along the coast, Maasslens to Ymuiden, gave very satisfactory results. A company of about 30 gentlemen witnessed the trial, and Mr. Vander Hoeven, as director of the Netherland American Steam Navigation Company, said in a speech at luncheon that the *Zaandam* was another good acquisition to their fleet of nine steamers running from Amsterdcm and Rotterdam to New York. We may mention that two of these have been built and engined at the Fyenoord yard of the Netherland Steamboat Company, the *Leerdam* for their Rotterdam, New York; the *Zuandam* for their Amsterdam, New York line.

TRIAL TRIP.—GERMAN.

George Dittman.—On the 29th June the s.s. *George Dittman*, built and engined by the Flensburg Shipbuilding Co., ran her trial trip in the Flensburg Bay. Her engines, which are 50 n.h.p., drove her at a speed of 9½ knots an hour, at a consumption of 4½ tons of coal in 24 hours. During the trial, everything worked to the entire satisfaction of all on board. The s.s. *George Dittman* is owned by the Flemsburg Shipbuilding Co., and has been specially constructed for carrying ship's plates, angles, bulbs, &c. On the 30th the above Company gave a grand festival to all their workmen to celebrate the construction of the 50th ship, the s.s. *George Dittman*. The festival commenced at 4 p.m. and lasted till the small hours of the morning; during that time there were all kinds of sports, music, dancing, fireworks, &c., &c., in fact, everything was done that laid in the hands of the Directors to make the event a pleasant and memorable one.

TRIAL TRIPS.—SWEDISH.

Arendahl.—This magnificent steamer, launched a time ago from the Motala Company's yard at Lindholmen, near Gothenburg, made her trial trip on the 7th of July. *Arendahl* is built for the mail route between Kristiania and Bergen, and the owners are, Arendahls, Dampskib, Selskab, in Arendahl, Norway. She is of the following dimensions:—Length, 170 ft.; breadth moulded, 27 ft. 6 in.; depth of hold from top of keel, 12 ft. 10 in.; height between decks, 7 ft. 4 in., except in the dining saloon, where the main deck is lowered for to make a more airy room. The saloons and state rooms will accommodate 70 first-class and 20 second-class passengers. During the trial trip the engine worked satisfactory, showing an indicated horse power of 445, with a speed of 11.63 knots. The material used in hull and boiler, shafts, etc., is of Motala Bessemer steel.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 23rd June to 27th July.

2904 J. Nixon, Taps and valves.
2915 W. J. Brewer. Hoisting gear.
2927 W. R. Lake (communicated by Grunow and Meyer). Raising water.
2948 W. R. Lake (communicated by F. F. Raymond). Valves, and packing for same.
2956 J. F. Stewart (communicated by Kirke and Fender). Separating dust from air.
2957 G. J. Cross. Preserving timber.
2958 Th. Penn. Valves and cocks.
2969 E. Edwards (communicated by J. Vernanchet). Preventing and removing sediment, &c., in steam boilers.
2973 Robert Boyle. Ventilators for ships, &c.
2977 E. de Pass (communicated by Volpp Schwarz & Co.) Supplying feed-water to steam boilers.
2979 H. J. Haddan (communicated by V. C. White). Ball and socket joints.
2984 G. Rodger. Marine steam-engines of the compound type.
2987 R. Duncan, Glasgow. Steam engines.
2993 E. Field and W. L. Thompson. Preventing, &c., incrustation, and operating a low-water alarm.
3012 J. Saunders. Steam steering apparatus.
3016 A. Taylor. Ascertaining the trim and initial stability o ships, &c.
3021 J. King. Detaching hooks.

3059 G. W. von Nawrocki (communicated by R. Jacobi). Preventing explosions of coal or other dust.

3061 T. Betbeder (communicated by E. Bourse). Magnetic compasses.

3067 J. Carr. Screw-propellers.

3071 W. Downs. Hooks for bulge barrels.

3075 W. Bell. Furnaces of steam boilers.

3080 J. A. & J. Hopkinson. Stop-valves.

3082 S. N. & N. Thornley. Heating and circulating water.

3092 Ch. W. Collins. Safety-valves.

3106 R. Bell. Propellers for steam vessels.

3115 L. P. Martin. Generators.

3118 J. T. Ward. Steam boilers.

3124 J. Hastie. Combined steam and hand steering apparatus.

3128 R. M. Lowne. Electric logs.

3132 A. M. Clark. (communicated by W. S. Phelps.) Valves.

3133 J. Jeffs. Producing and applying motive power.

3157 G. W. von Nawrocki. (communicated by T. K. Theis and others.) New hydraulic motor.

3171 W. W. Girdwood. Governing marine engines by electricity.

3180 A. Rickarby. Propelling ships, &c.

3184 A. M. Clark (communicated by W. F. Goodwin). Steam-engines.

3187 R. H. Brandon (communicated by A. Howatson). Supplying air to furnaces.

3203 H. Ch. H. Allen. Cleaning, &c., the sides of ships, &c.

3213 J. Thomas and Ch. J. Ennor. Valves.

3270 J., F. W., and W. W. Brierley. Rotary engines and pumps.

3275 A. W. Robertson. Surface condensing engines.

3280 A. Wightman. Taps and valves.

3282 J. Ingleby (communicated by Anhaltishe Mashinenban Actien-Gesellschaft, and G. Liegel). Fastening for lids, furnace doors, &c.

3286 A. R. Bennett. Preventing corrosion in boilers.

3292 W. R. Lake (communicated by R. L. Walker). Steam-boiler fire boxes.

3294 A. J. Boult (communicated by R. G. Brown). Regulating the speed of marine engines.

3300 B. Williams. Hoisting gear.

3304 J. P. Halket. Circulation of water in steam boilers.

3306 A. Lowcock and J. Taylor. Cleansing boilers.

3307 P. Goldschmidt and others. Rotary steam engines and pumps.

3312 G. R. Hugon (communicated by J. B. Lefèvre and P. Reneaux). Water level indicator for steam boilers.

3372 J. W. Restler. Cocks or valves.

3375 H. Robinson. Motive power for propelling vessels, &c.

3378 H. Meinecke, junior. Raising and steering apparatus.

3394 E. K. Leadbetter. Covering for pipes and boilers.

3416 T. J. Baker. Ventilators.

3425 H. A. Cutter. Ball valves.

3427 J. Pinchbeck. Rotary steam engine.

3432 E. G. Brewer (communicated by G. Hoper). Screw propellers.

3436 Ch. P. Boys. Engine power meters.

3437 D. R. Ashton. Cocks and valves.

3446 H. J. Haddan (communicated by F. H. Ball). Steam engine governors.

3450 Oscher Ber. Recording and indicating the direction of the wind.

3452 R. Duncan. Screw propellers.

3457 A. J. Boult (Communicated by I. Wensel). Finding distant points, &c., with the telescope.

3460 D. Purves. Crank shafts for screw steamers.

3478 P. R. Allen. Actuating the valves of and registering the work done by steam and other engines.

3493 Ch. Court. Rendering sail cloths, &c., water-proof.

3495 J. H. Shoebotham, and H. F. C. James. Connecting links.

3503 R. H. Holman & W. C. Draper. Hammocks.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

June 24th, 1882.

Ambler, Fred....	1 C	Hull.
Appleyard, Abrm.	1 C	N Shlds.
Armstrong, Jno.	2 C	Glasgow.
Auld, William...	2 C	do.
Baldwin, Wm.	1 C	do.
Bell, Adam T....	1 C	Glasgow.
Bladen, Chas. L.	1 C	do.
Blower, James...	2 C	Cardiff.
Cocks, James ...	2 C	Aberdn.
Copeman, Wm. C. J.	2 C	N Shlds.
Davies, John T.	2 C	N Shlds.
English, Walter	2 C	London.
Ewart, John B.	1 C	N Shlds.
Fraser, David ...	2 C	Lvrpool.
Fraser, William	2 C	N Shlds.
Garraway, Thos. A.	2 C	Glasgow.
Gibbs, John J. N.	1 C	Cardiff.
Jenkins, William	2 C	do.
Kelly, Lewis T.	1 C	Lvrpool.
King, John ...	1 C	do.
Laurie, Robert	2 C	Glasgow.
Lowe, Peter ...	2 C	Aberdn.
MacLaren, N....	1 C	Glasgow.
Macnaught, Geo.	1 C	do.
Martin, Andrew	1 C	Lvrpool.
McDougall, W. J.	1 C	do.
McEwan, Donald	2 C	London.
M'Intyre, James	2 C	Glasgow.
M'Intyre, Nicol	1 C	do.
Moore, George	1 C	Hull.
Mordue, John J.	2 C	N Shlds.
Pullen, James ..	2 C	Glasgow.
Richards, Wm.	1 C	Cardiff.
Ritchie, John ...	1 C	London.
Roberts, Edward	1 C	Lvrpool.
Sandiford, Josiah	2 C	N Shlds.
Simpson, Geo. Hay	1 C	London.
Warren, Henry	1 C	N Shlds.

July 1st, 1882.

Adamson, Wm.	2 C	Dundee.
Aitchison, Arth.	2 C	Lvrpool.
Anderson, G. W.	1 C	Sthmptn.
Appleby, Thos.	2 C	N Shlds.
Barber, Richard	1 C	do.
Briggs, Jonathan	2 C	do.
Burt, David ...	2 C	Glasgow.
Chapman, W....	1 C	Lvrpool.
Craven, Henry...	2 C	London.
Dix, Henry ...	1 C	Sthmptn.
Fyfe William O.	2 C	Dundee.
Gardner, Jno R.	2 C	Sndrlnd.
Gilbert, James	1 C	Lvrpool.
Giles, Martin ...	1 C	N Shlds.
Guy, James ...	2 C	Glasgow.
Harwood, John	2 C	N Shlds.
Hodgson, Stepn.	2 C	London.
Howie, Joseph	2 C	Glasgow.
Johnson, Wm.	1 C	N Shlds.
Kilpatrick, Stwt.	2 C	Lvrpool.
Laidler, Walter	2 C	N Shlds.
Lewis, John ...	2 C	Lvrpool.
Lupton, Thos. R.	2 C	N Shlds.
McPhail, Colin	1 C	Glasgow.
McRoberts, Jno.	2 C	Belfast.
Mair, John J. ...	2 C	Glasgow.
Neil, Colin C. ...	2 C	do.
Outhwaite, Alex.	1 C	Sndrlnd.
Patterson, Andw.	2 C	N Shlds.
Pollard, Chas. F.	2 C	London.
Scott, George ...	1 C	Glasgow.
Scott, Robert,...	1 C	do.
Shott, George...	1 C	London.
Sinclair, Chas. L.	1 C	Sndrlnd.
Smith, William	2 C	N Shlds.
Southern, Geo.	2 C	Sndrlnd.
Sutcliffe, Wm.	2 C	N Shlds.
Telford, Jas. Hy.	2 C	Sndrlnd.
Thompson, Jno.	2 C	do.
Thompson, S. P	2 C	N Shlds.
Throssell, Edwd.	1 C	Lvrpool.
Tripney, John	2 C	Glasgow.
Walker. Alex.	1 C	Aberdn.
Wallace, George	1 C	London.
Wilson, Wm. ...	2 C	N Shlds.

July 8th, 1882.

Annable, John,	2 C	Lvrpool.
Baillie, David ...	2 C	Glasgow.
Brown, James...	1 C	Lvrpool.
Buckell, Thomas	2 C	Lond[illegible]
Cathcart, Andw.	2 C	do.
Courts, John A.	2 C	Plymt[illegible]
Jeffrey, John ...	1 C	Lvrpo[illegible]
Knox, Thos. A.	2 C	Lond[illegible]
Packham, Alex.	1 C	Lond[illegible]
Park, Chas. Jas.	1 C	do.
Parkin, Walter Tom	2 C	Hull.
Robinson, John W.	1 C	do.
Small, Robert...	1 C	London.

July 15th 1882.

Aitken, John...	2 C	N Shlds.
Appleby, Wm.	2 C	London.
Ball, Thomas H.	2 C	do.
Barrie, Jas. Y. C.	2 C	Leith.
Bates, Charles J.	2 C	London.
Brockett. Chas.	1 C	N Shlds.
Brown, John T.	2 C	Glasgow.
Campbell, Arch.	2 C	do.
Canning. Henry	2 C	Cardiff.
Connell, Edward	2 C	Lvrpool.
Davies, William	2 C	Cardiff.
Dempster, Adam H.	1 C	Lvrpool.
Duncanson, Frk.	2 C	Lvrpool.
Fair, Lairn W. R.	1 C	Leith.
Ferguson, Alex.	2 C	London.
Fraser, Duncan	1 C	do..
Gamblin, Geo. E.	1 C	N Shlds.
Gillian, John ...	2 C	Glasgow.
Heslop, Thos. E.	2 C	N Shlds.
Hopkirk, John	1 C	Glasgow.
Hunt, F. C. ...	1 C	Leith.
Jack, John C....	2 C	do.
Jackson, Henry	1 C	N Shlds.
Johnston, James	2 C	Leith.
Kelly, George...	2 C	London.
Klintwort. John	1 C	Cardiff.
Lindsay, Wm. A.	2 C	Leith.
Maude, Geo. J.	2 C	do.
McGregor John H.	2 C	London.
McPherson, Duncan ...	1 C	Lvrpool.
Muir, Robert ...	2 C	Glasgow.
Owen, Thomas	1 C	N Shlds.
Putois, George	2 C	London.
Richmond, Geo.	2 C	Cardiff.
Saunders, T. ...	2 C	do.
Sinclair. Wm. ...	2 C	London.
Stewart, John...	2 C	Glasgow.
Thomson, John	2 C	Leith.
Tomlin, Henry R.	1 C	N Shlds.
Williams, Edwd.	1 C	Lvrpool.
Yeoman, Wm. S.	1 C	N Shlds.

July 22nd, 1882.

Anton, William	2 C	Dundee.
Arrowsmith, Simon	1 C	Lvrpool.
Butlin, Robert	2 C	London.
Cooper, Alex. ...	2 C	Dundee.
Cree, Peter Y.	2 C	N Shlds
Duncan, Robert	1 C	Glasgow.
Emerson, J. T.	2 C	N Shlds.
Gray, John ...	2 C	London.
Harkness, James	1 C	do.
Jackson, Arthur	2 C	Hull.
Laing, Alex. ...	2 C	N Shlds.
Leighton, Miles H.	2 C	Lvrpool.
Menzies, James	2 C	Dundee.
Milne, James ...	2 C	Aberdn.
Moore, George	1 C	N Shlds.
Murray, William	1 C	do.
Rankin, Robert	2 C	Lvrpool.
Ray, John F. ...	2 C	do.
Spring, George	2 C	Aberdn.
Stuart, Robert	2 C	do.
Thomson, John	2 C	Belfast.
Thomson, John	2 C	Lvrpool.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

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The Marine Engineer.

LONDON, SEPTEMBER 1, 1882.

EDITORIAL NOTES.

THE Americans are about to display their well-known energy and enterprise in the investigation of the fish products of the Atlantic, both at a moderate depth and also at extreme and hitherto inaccessible depths to ordinary fishers. They are building an iron steamer of 800 tons burthen, 200 ft. long, with a 27½ ft. beam. She is christened the *Albatross*, and is specially constructed for the Fish Commission, to gather and preserve sea-fish. She is to be supplied with a deep sea dredge, with eight or ten miles of wire rope for the purpose of dredging the depths of the Atlantic. She is being built at Pusey, Jones, & Company's yards, so the Americans do not feel disposed to be left behind in ship-building. Past Assistant Engineer G. W. Baird is superintending her construction, and she is to be launched in about four months. The coming fish Exhibition in London in May next, promises to be the most comprehensive ever collected together, and America seems to be exerting herself to show very creditably in it. All the leading fish culturists and dealers in the United States will send exhibits, which together with the millions of preserved exhibits sent by the American Government, will probably make their display the most perfect ever seen. The *Albatross* is to bring over a full cargo of exhibits.

NAVAL Education has long been a subject of discussion both in Parliament and in the Press, and it seems from very good independent authority that our system of education for Naval Officers is lamentably wanting in theoretical efficiency. We must not, however, overlook the obvious results, which have lately been so strongly emphasized at Alexandria, that whatever their educational deficiencies, they know how to fight and handle their ships in the face of the world. As far, however, as theoretical acquisitions, Professor Soley, of the United States Naval College, has pulled the *Britannia* cadets to pieces in a shocking way. Absolute statistics of the mathematical examinations of those cadets who had been six months out of the *Britannia*, showed that the average results are 32 per cent. in arithmetic, 28 per cent. in algebra, and 17 per cent. in trigonometry. These certainly are results which one cannot be proud of, more particularly as we understand that a very large proportion of such candidates work their problems in Navigation entirely by rule of thumb, without understanding the natural and mathematical principles of the problems. It is certainly an open question whether the time spent on board the *Britannia* by the cadets between 12 and 13 to 14 and 15 years of age would not be better employed at a good school. Surely also the next period of his service on board a man of war might be much better employed for some portion of it on board a seagoing training vessel. Iron-clads as at present constructed, pass far too much of their time in port, and seldom are under sail for any lengthened or critical periods. However, now that the *Navy* has itself undergone such radical alteration in construction, it is obvious that a corresponding alteration in methods of training for our cadets is likely to alter also.

THE ship canal to Manchester is by no means a relinquished project. Mr. George Hicks is again calling earnest attention to the matter, and the whole question of engineering feasibility and relative outlay and return have been once more gone through. The channel of the Mersey must be deepened and dredged above Liverpool, and in some places widened and trained; whilst the channel of the Irwell, which falls into the Mersey some distance above Liverpool, must be almost recut, so tortuous is its present course. The whole distance by water from Liverpool to Manchester would be only 37 miles, and the levels are such, that when the water is deep enough over the bar of the Mersey for any vessel, the tide would serve the whole way to Manchester for vessels of any usual draft, and would enable the ship to reach Manchester an hour or so later than its arrival at Liverpool. As to the probability of traffic, Mr. George Hicks estimates that at least 5,000,000 tons of goods would soon pass through the new tidal way per annum. From this traffic, the advocates of the canal see a revenue of £900,000 per annum, which would more than provide a handsome dividend on any capital likely to be required. The canal would terminate in a large dock of about an area of 128 acres in the neighbourhood of Old Trafford, and the whole capital outlay is estimated at a maximum of about £4,500,000, which is a mere flea-bite in these days of gigantic canal undertakings. The supposed saving to the local trades of Manchester is estimated at £1,214,000, even after payment as before given for dues and tonnage to the Canal Company. We should not be surprised to see this carried out.

THE Alexandria bombardment will have proved instructive to all naval powers, and we see that already a German Admiral has published his views on the value of ironclads for modern warfare. The conclusion he draws is that heavy armour in modern vessels to protect the machinery and the life of the sailors against modern heavy artillery is absolutely necessary. He considers that had the English vessels been less heavily armoured there would have been a great loss of life, and probably many of the ship guns would have been silenced. The Admiral is of opinion that no unarmoured vessels will be able for any time to continue an engagement with heavily armoured and armed ironclads or with coast defences. Although the ram and torpedoes will prove serviceable weapons in a sea-fight, they must by no means be exclusively depended upon, as the Admiral does not think they will ever take the place of heavy guns or armour for general purposes. It is, however, easy to see, he thinks, that in future sea-fights or disembarkations many small vessels of high velocity, or torpedo boats, will be largely used under the shelter of formidable ironclads.

THE *Grecian Monarch* has just satisfactorily completed her trial trip, and will soon be running on her appointed station between Liverpool and New York for the Royal Exchange Shipping Company, the owners of the Monarch Line. It will be remembered, perhaps, that the model of this vessel received the gold medal award as the best design for Transatlantic steamers. She is therefore a rather noteworthy build, and more than fulfils all the requirements for highest A 1 class in Lloyd's and the Liverpool Underwriters' Registry. She She is 400 ft. long, 43 ft. broad, and 33 ft. 3 in. deep. She has three iron decks sheathed with wood, the upper deck being of teak. She carries 850 tons of water ballast in a double cellular bottom, is 4,364 tons gross, and 2,832 tons net register. She is constructed especially to carry grain, cattle, and passengers, and it is her particular accommodations for all these varieties of freights that marks her out of the common. She is built in seven water-tight compartments, so we hope our energetic remonstrances as to the general lack of such precautions are bearing fruit. She has superb saloon accommodation for 50 first-class passengers, 60 second class, and 1,000 emigrants, whilst on the homeward voyage she will carry 700 head of cattle, and has a refrigerator for dead meat. She is rigged with four iron masts, and made an average of 12½ knots during her trial runs. She is built by Earle's Ship-building and Engineering Company, Hull.

THE London, Chatham and Dover Railway Company have added a steamer, the *Invicta*, to their channel service. She is 312 ft. long and 53 ft. in the beam, and averaged 18½ knots in her arrival trip with a short supply of coal. She has beautiful saloon accommodation lighted throughout by the Swan electric light, and has the electric light on each paddle box to facilitate embarkation and landing of passengers. The Company expect that she will cover the distance between Dover and Calais in an hour,

SHIPS *v.* FORTS.

A NAVAL engagement, either against an enemy at sea or against fortifications on shore, has become an event of exceedingly rare occurrence. It is to be therefore hoped, says the *Times*, that the utmost advantage will be taken of our recent experiences before Alexandria, both as regards ships and land defences. Sometimes a single incident will exercise a profound influence upon the operations of war, and necessitate important changes in respect of ships and armaments. There can be little doubt that the memorable action between the Federal *Monitor* and the Confederate *Merrimac*, in Hampton Roads, effected a complete revolution in the design of ships specially intended for harbour and coast defence, and stimulated the construction of the remarkable series of turret ships, mastless and otherwise, which stretches from the *Royal Sovereign* to the *Inflexible*. In like manner the battle of Lissa gave prominence to the ram. Probably the bombardment of the Egyptian forts will lead to further important modifications in our ships of war. The Government have promised an official report from Admiral Sir Beauchamp Seymour on the behaviour of the ships and guns under his command. This is looked forward to with the utmost impatience; but in the meantime it may be useful to direct attention to some of the lessons which may be deduced from the recent conflict.

It is in some respects unfortunate that our Navy should have been engaged in hostilities while in the throes of a violent transition —a transition affecting ships, guns, and men alike, for, with the increasing construction of mastless armour-clads, depending wholly upon steam for their motive power, the present picturesque blue-jacket will find his occupation gone, and it will be necessary to supply his place with a higher class of men, specially trained for gunnery duties. Our new ships will be armed with breech-loading ordnance and protected with steel-faced armour; and though no ships thus armed and protected took part in the bombardment, the results of the firing on both sides all tend to strongly justify the Admiralty in the changes which they are introducing. The action in front of Alexandria, if it proved one thing clearer than another, demonstrated that in a conflict between ships and forts the conditions are unequal, and emphatically against the former. In future years the disadvantages under which ships contend against land defences will be greatly modified; but they will always exist to a certain extent, and in the recent bombardment they were considerable. And, in the first place, it may be useful to remove a load of misapprehension from the minds of naval critics in Parliament and elsewhere, who are in the habit of contrasting the thinness of the armour of the Channel and Reserve Squadrons with the thickness of the protection possessed by our modern armour-clads, and denouncing the former as obsolete and entirely useless. But all iron armour is vulnerable, and against the guns now in use there is practically little difference in the amount of resistance offered by the sides of our ships. In his detailed account of the action of the 11th of July, Sir Beauchamp Seymour states that in the Ras-el-Tin batteries the large smooth-bores and the French 36-pounders were all but neglected, the Egyptians preferring to use the English 10-inch, 9-inch, 8-inch, and smaller muzzle-loading rifle guns. "These guns," the Admiral remarks, "are precisely the same as those which Her Majesty's ships carry, and no better muzzle-loading guns could be found." The volunteers from the *Invincible* destroyed with gun cotton two 10-inch guns at Fort Marabout, and repeated allusion has been made to the terrible fire of similar guns mounted within El Meks, the Lighthouse and other forts. They were lavishly supplied with projectiles of the latest description; and the Admiral adds:—"It is quite impossible for me to account for the very small loss sustained by Her Majesty's ships on this occasion, considering the amount of shell and shot which struck them, and the injuries inflicted on the hulls of the *Sultan*, *Superb*, and *Alexandra*, and in a lesser degree on those of the *Invincible*, *Penelope* and *Inflexible*." The surprise of Sir Beauchamp is justifiable, because the 18-ton gun does not make any nice discrimination between the various thicknesses of the armour carried by our ships of war. Up to a certain distance it penetrates them all alike. Charged with 70lb. of pebble powder the gun will send a Palliser 400-pound projectile through the side of the *Monarch* up to 3,500 yards; the sides of the *Hercules* and *Sultan*, the belt of the *Invincible*, and the turret of the *Monarch* up to 2,400 yards; the belt of the *Sultan* up to 1,600 yards; and the 11-inch sides of the *Alexandra* and *Hotspur*, and belt of the *Hercules*, up to 500 yards. It could do nothing more than riddle the 6-inch armour of the *Penelope* and *Invincible*, and the 4½-inch armour of the *Warrior* and *Minotaur*. The only difference is one of range, and the late bombardment has shown that the range, of accuracy is limited. While, however, the 18-ton gun can hole the 11-inch iron belt armour of the *Hercules* up to 500 yards, experiments on board the *Nettle* at Portsmouth have proved that the same gun fails to penetrate the armour of the *Collingwood*—of precisely the same thickness, but having a steel surface three inches deep—at a range of *thirty feet* and at right angles!

With the new protection of compound armour, which is being fitted to the *Edinburgh*, *Colossus*, *Impérieuse*, and the rest of the vessels now in course of construction, our ships would have been able to keep out the shot and shell of the Egyptians, and to have probably still further reduced the loss of life on board; though, as a matter of fact, being under the necessity of having to float, they will never be able to compete with forts in the factor of invulnerability. Comparatively little damage was inflicted upon the forts and guns of Alexandria, considering the terrific character of the bombardment. They were mainly silenced through the impossibility of the gunners, who were very inadequately protected, standing to their work, in consequence of the shell fire to which they were subjected from the ships, and the mitraille of *débris* which fell among them from their own too-solidly constructed earthworks, which did not allow the projectiles to bury themselves. This is another lesson which we should lay to heart. Every shot, on the other hand, from a fort tells, though not necessarily, fatally. It may bring down the masts with a run, causing momentary confusion on deck, as well as commit other damage short of destruction. But, when it is remembered that the machinery, boilers, steering-gear, torpedoes, and magazines of a ship, though protected, are still vulnerable to a lucky hit, and that its decks, which in the *Inflexible* are protected by 3-inch plating, and which are much thinner in other ships, render them particularly amenable to a plunging fire from a fort, it will be seen that the chances are materially against the ship. The disabling of a gun on board ship is a much more serious affair than the silencing of a gun on shore, since it can neither be repaired nor replaced. And should a hostile shell happen to explode in the boiler room, the ship would be compelled to retire, as an armour-clad would be totally unmanageable under sail.

In the matter of accuracy, again, the balance of advantage may be said to be on the side of the fort. So far as error is due to the gun itself, variations of velocity and projectiles, carelessness in laying, and unsteadiness due to the jump of the carriage, the conditions are probably equally divided. On board ship, however, there is another attendant scource of error in the instability of the gun platform, which makes correct laying particularly difficult, the more especially when firing ahead or astern, when the heeling must be carefully allowed for. Against this substantial list of drawbacks the ship has to set off the important advantage that it can shift position, and continually baffle the enemy's gunners by a varying range. It was, doubtless, to this circumstance that the ships under way were able to run the gauntlet of the Egyptian forts with comparative impunity. In fact, Sir Beauchamp Seymour attributes the escape of the unarmoured fleet, consisting of the *Bittern*, *Cygnet*, and *Decoy*, without the loss of a single man on board, though subjected to the fire of the Ras-el-Tin forts, "to the able manner in which they were manœuvred." Hence, it follows that for ships at anchor to engage forts is to discount the most important superiority which they possess. Wherever practicable they should engage under steam, and as the firing of the large guns with which our armour-clads are now armed demands considerably longer time than the 32 and 68-pounders with which Sir Robert Stopford attacked the defences of Acre, our late experiences would go far to prove that the most effective plan of attack is for the whole fleet to bring their guns in succession to bear upon forts *seriatim* until the whole are silenced. There are conditions of draught and range which will not always enable this to be done, but where a continuous fire can be directed from the entire attacking force upon a fort it is impossible for the gunners to work the guns. Such a method of attack has all the advantages of independent and converging fire. It affords each ship time to lay its guns and opportunity to fight them in its own way, without any break in the continuity of the bombardment. And as the fort constitutes a fixed target, the proper range can be always calculated beforehand for all bearings.

Taking this last-mentioned circumstance into consideration, some surprise has been expressed at the comparatively slight amount of injury that was inflicted in respect of the weight of metal discharged. Defective range-finding, if we may believe observers of the bombardment, had something to do with this, but the more probable cause of failure is to be found in the proved inefficiency of the fuses, both time and percussion, with which the fleet was provided. There were, so far as our information goes, no "prematures," but the "blinds" were scandalously frequent. It will be for the proper authorities to inquire into the cause. Time fuses are delicate instruments, and may fail from non-ignition, from being bored too long, and extinguished on graze, or from being put out by striking the water; but, as no preparation is required with percussion fuses beyond the removal of the safety pin, "blinds" are commonly attributed either to defective manufacture, or to defects inherent in the fuse itself. It may be questioned, however, whether a projectile from a long range, and with a high trajectory invariably strikes the object with its head. As a rule, the time fuse can be so little depended upon that a double-action fuse was introduced many years ago which combined the properties of the two classes. A percussion fuse was always used in shells for field purposes, so that, in the event of failure in the time fuse, there was still a probability of the other acting. This system, however, has not been applied to other shells as it would entail the use of metal time fuses instead of the wooden ones, which have been adopted as a measure of economy. But considering the value of the projectiles used in the navy, it is probable that the adoption of a metal fuse with double action would prove the most economical. The subject has engaged the attention of the Elswick Company and the Royal Laboratory, but has not as yet advanced beyond the experimental stage. It is also a matter for inquiry whether the system of gas checks adopted in the *Inflexible* does not detract from the value of the time fuse. The more perfect the action of the gas check as a preventative of windage, the more difficult it will be for the flash of the charge to reach the fuse composition. The many "blinds" which occurred among the costly shells thrown into Alexandria render an investigation into the whole subject of fuses imperative.

There is another question which our recent experiences in practical gunnery have brought into prominence. We refer to the manner of mounting guns on board ship. At the present time, and especially in the case of low freeboard ships of the *Inflexible*, *Neptune*, and *Dreadnought* class, our armour clads are built for engaging ships firing at or near about the same level, and are consequently placed at a serious disadvantage when engaging a fort, which, firing from a height, can direct a plunging fire at the weakest part of our ships. The Constructive Department have in part provided against the emergency by giving to the *Impérieuse* a sloping armoured deck and the protection of coal armour. But the barbette guns of the *Téméraire* have so clearly demonstrated their efficiency against the Egyptian forts that we should like to see the type of vessel multiplied, with such modifications and improvements as the Admiralty may see fit to introduce. The method of loading and training the guns of the turret ships, while having the advantage of complete protection, is both slow and cumbrous. In order to move the guns, which are the only things which are wanted to move, the whole mass of the turret must be rotated. If they are fired on the port beam they must be depressed and revolved to the starboard position, and if they are fired on the starboard beam they must be depressed and revolved to the port loading position, and then moved back again to port or starboard, as the case may be, for laying. This involves considerable loss of time, and the comparative deliberation of the *Inflexible's* fire enabled the Egyptain gunners to wait their time, and to take advantage of the interval which they knew must occur between the rounds to work their guns, rushing back to cover like a burglar when he hears the approaching footsteps of the constable the moment they saw the open ports of the turret ship bearing upon them. In the *Téméraire* the gun only moves, the turret being fixed. It cannot be seen by the enemy, it fires from a height and with a practically all-round fire, disappears after discharge, and is brought back to the firing position, not by a system of counter-weights, which would double the weight of the gun, but by hydraulic force acting upon a cantilever. With the adoption of breech-loaders, not only would there be an important gain of accuracy, range, and penetration, but the rapidity of the fire of the fleet would be increased, while the gunners would have greater protection afforded them. Even the fire of the turret ships now building, such as the *Edinburgh* and *Colossus*, will be accelerated by the change, but in ships of the *Téméraire* class the introduction of the breech-loading system will be attended with peculiar advantages. The recoil will depress the breech to the loading position automatically, and thus prove economical with respect to time, weight, and gear. As the turrets have not to be moved these can be armoured to any degree of thickness. In many ways the experiences gained before Alexandria are likely to prove of benefit to us as a naval power.

The continuation of our article on Electricity and its Modern Development, with special reference to Marine Engineering, is for want of space postponed to our next number.—ED. M.E.

SHIPS BUILDING FOR THE ROYAL NAVY AT PORTSMOUTH.

THE ships actually building are of types as widely different as can be well imagined. The only points of identity are that they are both made of steel, and are both intended to be propelled by steam. The *Calliope*, which was begun on the 1st of October, 1881, is an unarmoured corvette of the well-known and very numerous "C" class, of which two, the *Canada* and *Cordelia*, have recently made successful official trials of their engines. Of the vessels of this class it may be remarked that they are not so small as the "Gems" or so large as the *Bacchantes* but that they are enough—they will serve for the purpose for which they are designed. They are intended for independent service on foreign stations, for patrols and escorts, and for engaging with those wasps of the sea, from the operations of which it is supposed our commerce would suffer most in time of war. They are not designed as fighting ships, though, as it is proposed to arm them with the new 6 in. breechloading gun, they would probably scorn to fly from any enemy below the dignity of an armourclad. As the "C" class of vessels has been frequently described in *The Times* it will suffice to state that they were expressly constructed to execute, cheaply but no less effectively, the same duties as those for which the *Inconstant* and *Shah* were built. They are 2,383 tons displacement, while their engines are contracted to indicate not fewer than 2,300 horses. Their dimensions are 225 ft. between perpendiculars, 44 ft. 6 in. in extreme breadth, and 21 ft. 6 in. in depth of hold. The transverse frames are made of iron, but the skin plating, transverse, and other bulkheads, longitudinals, &c., are steel, while the stern and body posts and ram are composed of solid brass forgings. A useful feature in ships of this class is a steel shell-proof deck, 3 ft. 6 in. below the waterline, and extending over the whole length of the engines, boilers and magazines, while side plating, seven-eighths of an inch thick, is also fitted in wake of the deck and waterline. The stability of the hull is also protected by cellular spaces, watertight compartments, and coffer-dams. Though fully rigged and coppered to make them independent of coal and docking as far as may be, and thereby enable them to remain for long periods at sea, they are yet specially designed with large bunker capacity. The normal amount of coal which the corvettes carry is 270 tons, but in case of pressing necessity, they are able to stow as many as 370 tons. Upper and lower bunkers are provided, and as the latter may be emptied without interfering with the former, a strake of coal armour can be allowed to remain as long as possible in the neighbourhood of the waterline. The cellular spaces at the sides are also filled with coal. This arrangement not only affords a good protection against shot, but localizes to a single compartment any leak arising from shells penetrating the hull. The ships of the *Comus* class have proved themselves excellent sailers, while under steam they have realized a speed of 13 knots.

These results, however, while satisfactory as far as they go, are to be improved upon in the *Calliope*. To enable them to fulfil the service for which they were designed, fleetness is everything in corvettes of this type. They must have the power of overtaking and punishing the guerillas of the sea, and of avoiding a conflict with a powerful enemy; and in view of the extraordinary speed which has recently been attained by armed cruisers and merchantmen, the Admiralty have determined upon securing another knot for the *Calliope*, and the other ships of the class which may be built hereafter. In order to realize this extra knot, considerable alterations in dimensions and engine-power have been deemed necessary. These will best appear from the following comparison between the *Canada*, recently launched, and the *Calliope*, now in course of construction:

	Calliope.	*Canada.*
Length between perpendiculars... ...	235ft.	225ft.
Extreme breadth	44ft. 6in.	44ft. 6in.
Draught of water	17ft. 5in.	17ft.
	19ft. 11in.	18ft. 6in.
Indicated horse-power	3,000	2,300
Speed in knots	13⅜	13
Coal stowage	320 tons.	270 tons.
Ship's company	280	245
Guns, 6-inch B.L.R.	10	6

In other respects the two vessels are very similar, the points of difference in respect of hull being mostly of such a character as require a professional eye to detect. There are, however, one or two departures from the established pattern which remain to be pointed out. The Normandy condensers will be placed immediately before the boiler-room, while in the *Canada* they are fixed in the boiler-room itself. In the *Calliope*, again, the ventilator to the engine-room will be protected by a coffer dam to the height of the steel deck. In the *Canada* increased resistance to a shot raking into the engine-room is obtained by a two-inch armour plate. The *Calliope* will also be fitted with four sponsons for 6-in. guns projecting beyond the side—viz, two forward and two aft, while the sister ship will have only two in the forward positions. These sponsons are an entirely new feature, and did not enter into the original design. They are semi-circular projections from the ship's sides on the upper deck, and sufficiently large to allow of fire from the foremost sponsons through an angle measured from line ahead to 45 degrees abaft the beam, while similar astern and broadside fire will be obtainable from the guns on the after sponsons. The *Calliope*, like others of her class, will be fitted for Whitehead torpedoes and machine guns. She is at present in frame.

The *Impérieuse* the construction of which was begun in August, 1881, though differing as widely as possible in every respect from the *Calliope*, is yet to be regarded as a necessary sequel. In making his statement last March, Mr. Trevelyan observed that, while it was necessary to lay down additional ships of the "C" class, it was also imperative to build a vessel which should not only have the heels of another, but would be able to meet on at least equal terms almost anything she was likely to catch, for a cruising armour-clad of the type desired, it was desirable to procure a speed of 16 knots, a comparatively large number of guns, some of them capable of penetrating the thickest armour of second-class ironclads at long-ranges, armour of proof to protect the vitals of the ship, a large coal supply, auxiliary sail power to economize fuel, and a copper bottom to render her independent of docks. Such a phenomenon, it is supposed, the country will possess in the *Impérieuse*, a sister ship of the *Warspite* under construction at Chatham. Her length is 315 ft., breadth 61 ft., draught 25 ft., displacement 7,390 tons, and horse-power 8,000 horses. She will carry four 18-ton B.L.R. guns mounted in barbettes, and six 6 in. guns on the broadside capable of penetrating 12 inches of armour. Two of the barbettes will be built across the middle line forward and aft, and the rest abreast of each other at the sides amidships. The heavy guns are situated at twice the height out of water that they are in the turrent ships, and they can be fired, three together, in any direction—ahead, astern, or on the beam. The armour on the sides of the citadel will be 10 inches thick, that across the ends nine inches, that on the barbettes eight inches, while the armour protecting the pilot tower will be 10 inches thick. The whole of the protection will consist of the new steel-faced armour. The peculiar shape of the iron beams, which are to support the armoured deck containing the coal armour, is what mainly distinguishes the *Impérieuse* from other ships in a similar state of progress. These are bent downwards at the ends, so that the sloping contour of the deck at the sides will cause shots to glance off. Her bunkers will be able to store the extraordinary quantity of 1,200 tons of coal. She will be brig rigged, and will carry a good spread of canvas. The *Impérieuse* is not yet entirely in frame, but the stem and stern ports have been fixed in position, and the bottom plating is well in hand. The magazines, divisional bulkheads, and cork passages are also being advanced, while the 3-in. armoured deck is completed.

Of the new ships which are being completed, the most important are the double-turrent ships *Neptune*, *Dreadnought*, and *Colossus*. As the two first-mentioned could be got ready for service in a fortnight, they may be dismissed in a line. So long as they are allowed to remain within the Dockyard there will always be found something to do to them, and they will never be any nearer completion than they are at the present moment. When the Admiralty made their last inspection, on the 3rd of October, upwards of 3,300 tons of weight had been worked into the *Colossus*, and she was being prepared for launching. The skin plating had been nearly completed, some of the citadel armour had been fixed in position, and the only work which was somewhat in arrear was the erection of the turrets, which had been retarded in consequence of some indecision as to the size and weight of her armament, and the necessarily backward state of the hydraulic arrangements for working the guns and turrets. She was launched in March last, since which time she has been pushed forward with as much expedition as circumstances would permit. She will carry two 43 ton guns in each turret, and, as they will be of the new breechloading pattern, great variation in the turret and hydraulic arrangements from those of the other turret ships has been necessitated. In the *Inflexible*, for instance, the central pivot on which the turrets are made to revolve is 4 ft. 6 in. in diameter, but in the *Colossus* the pivot, which really forms the turret floor, is 14 ft. in diameter. It is surrounded by a steel ring, on which the whole superstructure of the turret is built, and is made to rotate within a sort of shallow well, of which the rim constitutes the part along which the conical bearing rollers travel. As the breech of the gun is depressed to the loading position, it sinks into the well to the level of the lower deck, where it is charged by means of a hydraulic rammer. As this rammer works through a jointed trough which lies flush with the deck, except when elevated in the act of loading, a perfectly clear deck is obtained. After being loaded the breech of the gun is raised by a hydraulic press, and can be elevated or depressed to any required angle. The turrets, which are well advanced, are to be armoured with 14 in. of compound armour manufactured on the Wilson patent, while 16 in. plating will be fitted in wake of the port plates. The fore turret has received all its backing, while the pivoting ring, roller paths, &c., are being bored out in readiness for the turret to be dropped into its place. The cradle and conical rollers for traversing the turrets are also well in hand, and are being pushed forward to allow of the turrets being lowered to receive their armour. The after turret has had its backing nearly completed, while the hand and hydraulic locking bolts are fitted, and the path for the locking bolts nearly so. Progress has also been made with the hydraulic lifts for bringing the ammunition and projectiles from the magazines. and with the loading troughs in the citadel deck. Messrs. Maudslay have fixed the main portion of the machinery and boilers on board, and are now completing the pipes and general fittings so as to be able to take the ship out for trial about March next. The capstan engine is completed, and the steering machinery is being made by Mr. P. Brotherhood. The separate condenser, which was found necessary on board the *Inflexible*, on account of the extent to which the auxiliary machinery was used, is to be fitted to the *Colossus*, as well as to the other ships of the class now building. The character of the torpedo and other independent machinery on board is settled, and will be advanced as rapidly as possible, so as to be completed by the time of the steam trials. The question of bunker ventilation, like the question of the stowing of magazines and shell rooms, remains in abeyance. But while the ventilation of the coal bunkers and spaces awaits the decision of the Bunker Committee, the other ventilation is well in hand. The system consists of a large trunk running through the ship fore and aft, with outlets into the engine and boilers rooms, and the other parts of the ship. Into this trunk air is blown by four large fans, driven by Brotherhood engines: two in the engine room, and two in the fore stokehole. Two additional fans, also driven by engines of the same maker, are to be fitted in the engine room for exhausting the hot air from the tops of the cylinders. The outer bottom of the ship has been freed from launching gear, while bilge keels have been fitted and riveted in readiness to be attached to the structure. The 6-inch guns to be carried by the *Colossus* are to be mounted on the Vavasour slide arrangement, and designs are to be prepared at once so that the work may be proceeded with. The *Canada* and *Cordelia* are being prepared for the reception of their armaments and completed for sea. Their machinery has been taken over from the contractors, and the engineering department of the yard is busy with the ventilating and torpedo arrangements. These ships are to be fitted with the new air-gun, which is rapidly superseding the old impulse tube for ejecting torpedoes. The system has long been used by Whitehead, but is only now being introduced into the service. The success obtained from it up to the present time is very considerable. The *Mercury*, despatch boat, is almost ready for commission. She has been fitted with another steel crank-shaft in place of the one which fractured during her steam trial, and has had a satisfactory six hours' full-power run. Much of the success attending it was due to the new centrifugal lubricators which have been fitted to the crank-pins by the Dockyard engineers. The oil is conveyed through a hole in the centre of the pins to the brasses by centrifugal action, and the ships to which the new lubricator has been supplied have run comfortably at full speed without any water service being required. This catalogue exhausts the list of the new ships building and completing for sea.

While, however, preference has been given to new work—to the construction and completion of ships—it would be misleading to say that nothing has been done in the way of repairs and refits. The overhaul of the Indian troopships itself has been a long and costly undertaking, and has, in fact, put a strain upon the resources of the establishment which it was unequal to meet, the *Jumna* having had in consequence to be sent to Chatham. The *Serapis* and *Crocodile* have nearly completed an overhaul from the waterline downwards, but the repair of the *Euphrates* has been of the most thorough description, and as the two former will be again taken in hand next year, a brief account of what has been done to the

Euphrates will convey a good idea of the ordeal through which it is intended, as time and convenience permit, to pass the whole fleet, and which is rendered necessary by the length of time they have been running between Portsmouth and Bombay without undergoing a critical examination of the hull structure. When these splendid vessels were built, there prevailed a system which marked the transition from the purely wooden period to the period when iron had become very largely employed in shipbuilding. The troopships were lined or planked over on the inside surfaces of the frames or ribs, and as this lining forms the walls of the cabins and living spaces, it was impossible to get to the bottom and side plating, which becomes oxydized in course of time, for purposes of examination. It was consequently necessary to remove as much of the planking as would allow of the scale and rust being chipped off, and the plating painted throughout. Small holes were drilled through in sufficient number to test the thickness of the iron which remained after being denuded of rust, after which the lining was replaced in a portable manner, so as to permit of the skin being periodically examined. The whole of the old decks, which had become much worn, have been removed and replaced by new ones. Steam-steering machinery has been fitted, by which means the rudder can be put hard over to either side in 15 seconds, with a steam pressure of 30lb. to the square inch, while the vessel is proceeding at full speed. Additional strength has also been given to the rudder to enable it to resist the increased torsion or twisting strain brought upon the head by the superior power of the engine. A new drainage pipe commanded by the engines as well as by the ordinary pumps, has been provided. Into this the bilge water from each of the compartments of the hold finds its way by gravitation, and thus enables the interior of the hull to be kept perfectly dry. Several of the store rooms which had become rotten and would have caused unwholesome smells have been rebuilt. An additional luxury has been conferred upon the saloon passengers by the erection of a double row of punkahs which are actuated direct from the main engines, and produce a never-failing current of air. Another ingenious alteration has been introduced on the troop decks. Originally the leakages from the ports ran into pockets inserted within the interior lining of the ship, where they could neither be seen nor got at. The result was that the overflow escaped down the sides of the vessels, causing serious decay to the wood and iron, and producing offensive odours. The pockets have now been fitted outside the lining, where they can be easily emptied when full. And, should any neglect in this respect take place, the overflow would trickle upon the troops and mess tables below, and thus effect its own cure. These renovations and improvements, together with the thorough cleaning and repair which she has undergone, ought to make the *Euphrates* a perfectly healthy and comfortable ship for the transport of our troops to and from India. The *Malabar* and *Orantes* will be taken in hand during the present financial year.

The *Devastation* is, and has been for many weeks, practically ready for sea. The ships whose refits have been deferred are mostly of the unarmoured class, of which there is no want at the present time. The repairs of the *Shah* were well in hand when the Admiralty ordered her to be stopped and the hands transferred to the *Rupert*. The boilers of the armour-clad are in a very bad condition, and she will be required to steam for some time at a reduced pressure. The machinery generally stands in want of heavy repairs. The machinery of the *Elk* has been repaired and fitted in place, and the ship steamed on trial, by the engineer students; while the *Avon*, whose engines have been completed by the younger students, is now being prepared by them for steaming. Some progress has also been made in the refits of the *Active* and *Volage*. As usual, however, the ship-building programme has been somewhat over-estimated; and as the casual work cannot be arrested, the new work and repairs, in spite of stringent orders from the Admiralty, inevitably falls in arrear. The only remedy for this is to increase the vote for the Yard, and to distribute the new work in such a way as to enable a large casual repair to be undertaken without the expensive necessity of stopping the work on other ships. In all probability, the practice of contracting for the overhaul of a ship's machinery will not be long continued. These jobs are much sought after by private firms, as the profits are considerable and the responsibility *nil*. The *Active* is the only vessel at Portsmouth whose engines are now under repair by contract. During her full-power run both of her old cylinders cracked, and as the contractors were in no way to blame for the breakdown, the new cylinders were separately contracted for. These have just been placed on board. The cost of her machinery refit up to the present date, exclusive of the new cylinders, has been considerably in excess of that of the *Volage*, which has been completed by the Dockyard Engineer Department.

HYDRO-CARBON OR CONDENSED FUEL FOR THE GENERATION OF STEAM FOR STEAM-SHIPS.

AS in the substitution of a fuel other than coal for steamships, the points of advantages to be sought for are not only in economy of fuel, but equally in less weight to be carried, less room required for storage, perfect combustion of the fuel, absence of smoke and burning cinders and ashes which are constantly being projected on board steamships using coal for the generation of steam. To attain such results, Mr. Robert Walker, C.E., of 13, Buckingham-street, Adelphi, W.C., has been most assiduously striving for some years past, and according to the reports of the actual working of his patented Hydro-Carbon Furnace and Apparatus, we appear to have arrived at the *ne plus ultra* of perfection in the production of the means of creating the, at present, most important motive power we possess, viz., steam. To produce heat, atmospheric air, as Bunsen showed us, is the most effective ingredient in the fuel used, requiring no storage room, and having no appreciable specific gravity. Without air no combustion can be maintained; but as air is proverbially fine, it is the mode in which Mr. Walker has subjugated this common air to his uses, that constitutes one of the true merits of his invention in combination with his mode of burning the crude hydro-carbon or heavy mineral and other oils the supply of which is now far in excess of the world's demand. The specific gravity of these oils is 1.050 and upwards, and, therefore, they sink in salt water, and they are not inflammable under a temperature of 240 deg. Fahrenheit. In case of a ship catching fire, they are infinitely less dangerous than coal, beside not being liable to spontaneous combustion, for if run into the sea they would sink there, or even if run into the hold, where some bilge water existed, they would sink below it, or rather rise the water to the surface, and would not take fire under these conditions, even if the ship was burning fiercely above it; nor can it be inflamed by any device short of raising the temperature of the wood to 240 degrees, and the oils with it, and then applying flame, a spark would not light it. A white hot fire-brick may be plunged into the oil with the most perfect impunity; consequently, the idea of danger from the use of this condensed fuel may be dismissed at once and for ever, as there is, in point of fact, less danger in carrying and in burning this hydro-carbon fuel than there is in using the best steam-coal. The advantages of this condensed fuel for steamships are reported as follows:—

1. One ton of hydro-carbon fuel, burned by Mr. Walker's patented method, generates as much steam under ordinary circumstances as six tons of coal, and under certain favourable circumstances, much more.
2. One ton of coal measures (according to naval allowance) 48 cubic feet; the equivalent in bulk of hydro-carbon fuel only measures 16 feet: the difference, then, in favour of the latter is 32 cubic feet per ton, and the Hydro-Carbon Fuel as burned by this patent generates upwards of six times as much steam as the best steam coal.
3. Economy of 70 per cent. in manual labour.
4. Regularity of combustion and equality of temperature.
5. Instantaneous extension or diminution of the fires in case of need, or when required.
6. Absence of danger of fire. The usual dangers of steamships is much diminished by this process, everything being closed up, and no sparks or burning cinders being projected.
7. Absence of loss by smoke, cinders, ashes, &c.
8. Cleanliness, faster and steadier voyages.
9. The fuel can be utilized to light the ship with hydro-carbon gas, thereby deriving economy, comfort, and placing the control of all the lights on board the ship in the hands of a proper person, viz., the Captain.
10. The control of the fires can be in the hands of one responsible person.
11. The existing and increasing abundance of hydro-carbons fit for the purpose.
12. The patent hydro-carbon furnace and apparatus can be added at small cost to the existing furnaces of steamships without any alteration of the engines, boilers, or furnaces.

Thus having obtained the perfection of steam fuel, and a proper mode of using it, with a minimum of labour employed, nominal space required, perfect freedom from waste products of combustion, and consequently absence of smoke, sparks, or dirt. This invention may be regarded as the greatest discovery of the age, for the comfort and convenience of our steam Mercantile Marine, and particularly ocean-going steamers for our colonies. The production of steam, with coal as fuel, is attended with disadvantages which science has long endeavoured to overcome, hitherto with little practical results. Mr. Walker has at once gone to the root of the evil by dispensing entirely with coal, and the chemical purity of the fire he substitutes, and the entire absence of sulphur and phosphorus in it, will have a beneficial effect on the boilers, while for the smelting of ores and metals, this hydro-carbon fuel (with which an enormous degree of heat can be quickly and easily be attained), must prove very valuable in producing the purest and most perfect quantities of wrought-iron and steel suitable for tools, plates, machinery, and all kinds of iron building materials.

Mr. Walker's patent hydro-carbon furnace and apparatus covers a mode or method by which common air is rapidly converted into hydro-carbon gas of great heating power, which, as soon as made, passes into a receiver subjected to pressure, and is thereby immediately forced out through a pipe to the burners, from which combustion takes place between and slightly underneath the fire bars in the furnace. Upon these bars are fixed lumps of incombustible fire clay, made up as a coal fire would be, but having this great difference, viz., that being indistructible by fire they remain intact. When the hydro-carbon gas is lighted the flames rise in vivid combustion through the firing, and the furnaces get heated, and the air within becomes hot and rerefied. Then one or more of the series of injectors are started and inject crude hydro-carbons, in the form of fine spray, into the already hot furnace. The force of the blast drives the spray some distance into the furnace, and discharges it, finely divided and mixed up with the air, over the red hot firing and blazing hydro-carbon gas, and thus complete and effective combustion instantaneously takes place, and is maintained with regularity and equality of temperature, and the flame passes along the flues as in the case of an ordinary fire, but without producing either smoke, sparks, or dirt, and when once the apparatus is set in operation the stoker may leave the engine-room, for as long as the oils last the fires will burn regularly, and in exact caloric effect to the quantity of fuel injected into the furnace. If we analyse the effect produced by this mode of combustion we shall find that the heavy oils, projected in the form of minute globules into the heated furnace, present a great heating surface to the oxidising effect of the air which surround them, and which has been their vehicle, therefore they get inflamed instantaneously throughout the mass and pass off in pure flame. The residue of this combustion which takes place in this finely-divided state being so minute—$\frac{1}{5,000}$ part of each original globule, they are in consequence totally carried away by the draught: and at the same time the globules or fine spray being on all sides enveloped in air perfect combustion is attained, and, therefore, no smoke nor any deposit of unburned carbon, and consequently there will be no ashes to get rid of, nor will there be any drawing of the fires. Banking will be replaced by one or more of the injectors being kept burning under the largest boiler, and immediately the supply tap is turned off the fire is out, thus having all the fires under the instantaneous control of one responsible person—a very important matter, especially on board ship. The profit accruing from saving in storage will be considerable, but the advantages do not end here, for if we take the heating power of coal per pound, as carried out in the construction of our boilers and furnaces, we will find that only a small proportion of the heat theoretically developed can be made use of, whereas, by burning hydro-carbon gas, and crude or heavy oils in a gaseous form, as we have before mentioned, the comparison of useful caloric effect obtained from coal and hydro-carbon fuel—burned in the same furnace—stands thus, viz., that in the pound of coal only 50 per cent., or one half the caloric effect is utilised, which is probably much over rather than under the mark, whereas, in the burning of the hydro-carbon fuel 100 per cent., or the whole as nearly as possible is utilized. The comparison, then, that one pound of hydro-carbon fuel as burned by Mr. Walker's patent, being equal in caloric power to six pounds of the best steam coal is fully justified. These advantages are immense, and must soon effect a complete revolution in our present mode of generating steam in our Navy and Mercantile Marine. For steamers making long voyages the use of this valuable invention would be most important, as it makes voyages to China and Australia from England, and from American ports on the Pacific coast quite easy of accomplishment, instead of being, as is the case at present, most difficult and expensive, owing to the excessive quantity of coal they require, and the excessive price which, in those distant seas, they are obliged to pay for it. Take for example, one of the Royal Mail Company's steamers plying between Southampton and Central America. For the outward voyage she requires to take on board at Southampton 800 tons of steam coal, costing say £800, and for the return voyage a further 600 tons of steam coal at Jamaica, costing say £1,800, total 1,400 tons, costing say 2,600. The substitution of hydro-carbon fuel, as burned by Mr. Walker's patent in lieu of coals, would require 134 tons to be put on board at Southampton and 100 tons at Jamaica, total 234 tons, costing say £600. The difference in price between the two fuels would be therefore £2000 in favour of the shipowner, by adopting Mr. Walker's patented hydro-carbon furnace and apparatus, which can, at trifling cost, be added to the existing furnaces without any alteration of the engines or boilers. Further, there would be additional space available for freight-paying cargo on the outward voyage for 666 tons, and on the homeward voyage for 500 tons, making together 1,166 tons. If this space were occupied by even the least profitable description of cargo, it would be worth, to the Royal Mail Company, from £2,000 to £3,000 per voyage, and the saving in wages, loading, coal, wharfage, time, &c., would be equivalent to a further £500, or an additional profit at the rate of from £4,000 to £5,000 on the outward and homeward voyages. For use in the Navy this invention would prove equally important and profitable. In time of war our largest ironclads, as now constructed, would never be able to cross the ocean without being surrounded by a fleet of colliers to supply them with coal. The *Devastation*, although built as a sea-going war-ship intended to cross the Atlantic in time of war, can only store coal on board for a cruise at full speed of from four to five days. She might store sufficient hydro-carbon fuel, as burned by Mr. Walker's patent, to steam about thirty days at full speed. Thus, say the *Devastation* now burns 2 lb. 5 oz. of coal per horse-power per hour, and that she develops 4,000 horse-power and stores 500 tons of coal; consequently she has coal for full speed for about 4½ days, but by burning hydro-carbon, which, as we have shown, can give fully six times the evaporative duty of coal, she would then be capable of fulfilling effectively the purpose for which she was intended with immense advantages and economy to the nation, and this remark applies to the navy generally, for few of our ironclads carry more than three days full steaming of coal. We therefore expect to learn before long that the Admiralty have adopted Mr. Walker's patent, as there can be no question of the advisability of so doing in the Navy as well as in our steam Mercantile Marine.

We understand that Mr. Walker, after years of labour and expense in the perfecting of his invention, is now arranging to sell his patent to a Limited Company forming for that purpose, and to work the system forthwith, and that Admiral J. H. Selwyn, R.N., is the chairman, This in itself is a guarantee that the advantages stated are not over-estimated. As it was, that able officer, who carried out the Admiralty experiments in connection with the burning of hydro-carbon for the generation of steam, and the fact that he, who has such great experience on the subject, identifies himself with the company in such a prominent manner is most satisfactory, as it is only by the combination of capital and commercial enterprise that great inventions are carried out in this country. This is one we naturally look upon with special interest as being of such great importance to all those interested in the economical, successful working, and continued supremacy of the steam Navy and Mercantile Marine of Old England.

STEAMSHIP VENTILATION.—At Avonmouth Dock, Bristol, last month, a trial was made, on board the steamship *Warwick*, of "The Norton House and Ship Ventilator," the invention of Captain Francis I., Norton, late of the United States Navy. The *Warwick*, which is a fine steel-built vessel for service in the American trade, is the latest addition to the Great Western Steamship Line, and is the first steel-built vessel which has entered the port of Bristol. The apparatus belonging to this ventilator, which is designed not only for the ventilation of ships, but for use in houses, tunnels, and mines, consists essentially of a system of pipes connected with apartments or spaces to be cleared of foul air, and communicating through a clapper valve with an exhausting and forcing device. It exhausts 52,000 cubic ft. of air per hour from the different parts of the ship, and renders cowls unnecessary; the *Warwick*, indeed, is the first vessel passed by the Board of Trade officials without cowls. The apparatus can be worked with a donkey engine, and occupies a very small space, the engine-room being used for its accommodation. The Norton automatic ship ventilator designed especially for the ventilation of sea-going sailing vessels, is operated by the movement of the ship, and can be used at sea when the power ventilator is not required to be used. The system is applicable wherever artificial ventilation is necessary, and there are few enclosed places where it is not. The ventilator has been tried at the Criterion Theatre, London, and though other systems had partially failed, this theatre is now regarded as one of the best-ventilated public buildings in the metropolis.

DIMENSIONS AND PERFORMANCE OF THE HULL AND MACHINERY OF THE UNITED STATES STEAMER "DISPATCH," WITH ANALYSES OF THE POWER DEVELOPED.*

By Chief Engineer ISHERWOOD, U.S. Navy.

Continued from page 122.

THRUST OF THE SCREW DURING THE ABOVE PERFORMANCE.

The thrust of the screw, as it would have been measured by a dynamometer, during the above performance, calculated from the data therein given and in the distribution of the power is as follows :

The horse-power expended in the propulsion of the vessel according to the distribution of the power, being 269·1766 is equal to (269.1766 × 33000=) 8882827·8 foot-pounds of work per minute; and the speed of the vessel being 10·75 geographical miles per hour, the resistance of the vessel at that speed, or its equivalent the

DETERMINATION OF THE POWER EXPENDED IN OVERCOMING THE RESISTANCE OF THE WATER TO THE IMMERSED EXTERNAL OR WETTED SURFACE OF THE HULL.

Taking the resistance of the water to one square foot of rolled copper surface, moving in it with the velocity of 10 feet per second, to be 0·45 pound; and at other velocities to be this quantity modified in the ratio of their squares to the square of 10; and deducing from the speed of the vessel the mean speed of its immersed surface due to the inclination of its horizontal water lines to its longitudinal central plane, there results for that speed 18 feet per second; and, consequently, a surface resistance of (10^2 : 0·45 : : 18_2 :) 1·458 pounds per square foot moving with that velocity.

As the immersed external or wetted surface of the vessel during the above performance was 5576 square feet, the power expended horses, which are substantially the same as the 269·1766 horses-power expended in the propulsion of the vessel, according to the preceding "distribution of the power" developed by the engines. In other words, the entire resistance of the vessel was sensibly that of the water to its immersed external surface; and, consequently, no engine power was expended in overcoming the resistance of the water to displacement by the progress of the vessel. That is to say, the difference between the power exerted by the fore body of the vessel in raising the displaced water from the centre of gravity of the greatest immersed transverse section of the vessel to the general water level, and the power exerted upon the after body of the vessel in the direction of its motion by the ascending column of water caused by the forward movement of the vessel, were sensibly equal.

In the *Dispatch*, therefore, as in many other excessively sharp vessels, with long after bodies relatively to combined draught of water and speed, nearly or quite the whole of the engine power applied to the propulsion of the vessel is expended in overcoming the resistance of the water to its immersed external surface; the power exerted by its fore body in displacing water being nearly or wholly recovered by the power exerted propulsively on its after body by the column of water rising vertically to fill the void left by the passage of the vessel.

AVERAGE PERFORMANCE UNDER THE CONDITIONS OF ORDINARY PRACTICE, IN SMOOTH WATER UNINFLUENCED BY WIND OR CURRENT.

The following is the average performance of the *Dispatch*, in the Potomac River and Chesapeake Bay, under the conditions of ordinary practice, and embracing the whole of her steaming from November 8, 1880, to March 30, 1881, the water being smooth and the breeze gentle abeam. During this steaming there were in the bunkers, on an average, 90 tons of coal, the full quantity being 130 tons. The aggregate time of steaming was 358 hours; the fuel was anthracite consumed by natural draught. The vessel's draught of water during this time averaged 11 feet 2 inches forward and 12 feet 10 inches aft, A regular tabular log was kept, indicator diagrams were taken at intervals, and all the quantities were accurately ascertained.

HULL.

Vessel's mean draught of water in feet	12·
Vessel's greatest immersed transverse section, in square feet, including projection of bilge keels ...	191·3
Vessel's displacement, in tons, including bilge keels	559·
Vessel's external immersed or wetted surface, in square feet, including surface of bilge keels	5516·

ENGINES.

Steam pressure in boilers, in pounds per square inch above the atmosphere	49·3
Position of the throttle valve	⅜ open.
Fraction of the stroke of the pistons completed when the steam power was cut off	0·112
Number of times the steam was expanded	5·8872
Vacuum in the condenser, in inches of mercury ...	25·50
Pressure in the condenser, in pounds per square inch above zero	2·45
Barometer, in inches of mercury	30·
Number of revolutions made per minute by the circulating pump	125·
Number of double strokes made per minute by the pistons	59·484

RATE OF COMBUSTION.

Pounds of anthracite consumed per hour	1253·50
Pounds of refuse per hour from the anthracite, in ash, clinker, etc.	269·50
Pounds of combustible or gasifiable portion of the anthracite consumed per hour	984·00
Per centum of the anthracite in refuse of ash, clinker, etc.	21·50
Pounds of anthracite consumed per hour per square foot of grate surface	12·535
Pounds of anthracite consumed per hour per square foot of heating surface	0·5662
Pounds of combustible consumed per hour per square foot of grate surface	9·840
Pounds of combustible consumed per hour per square foot of heating surface	0·4444

TEMPERATURES.

Temperatures, in degrees Fahrenheit, of the air on deck	62·5
Temperature, in degrees Fahrenheit, of the air in the engine room	91·0
Temperature, in degrees Fahrenheit, of the injection or refrigerating water	63·5
Temperature, in degrees Fahrenheit, of the discharge water	85·0
Temperature, in degrees Fahrenheit, of the feed water	107·9

SPEED.

Speed of the vessel per hour, in geographical miles of 6086 feet	9·9195
Slip of the screw, in per centum of its speed ...	15·00

STEAM PRESSURES IN CYLINDERS, PER INDICATOR.

Pressure on pistons, in pounds per square inch above zero, at commencement of their stroke	48·60
Pressure on pistons, in pounds per square inch above zero, at point of cutting off the steam	46·80
Pressure on pistons, in pounds per square inch above zero, at end of their stroke	11·15
Mean back pressure against pistons, including cushioning, in pounds per square inch above zero ...	5·90
Mean back pressure against pistons, for the portion of their stroke during which the stream was not cushioned, in pounds per square inch above zero	5·28
Back pressure against pistons, in pounds per square inch above zero, at the point where the cushioning of the steam began	5·00
Indicated pressure on the pistons, in pounds per square inch	18·434
Net pressure on the pistons, in pounds per square inch	16·684
Total pressure (exclusive of cushioning) on the pistons in pounds per square inch, reduced in the ratio of the stroke of the piston to the fraction of the stroke completed when the cushioning began ...	22·834

HORSE-POWER.

Indicated horses-power developed by the engines ...	314·2979
Net horses-power developed by the engines	284·4605
Total horses-power developed by the engines ...	389·3174
Total horses-power developed from the expanded steam alone	323·2320

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*From the Journal of the Franklin Institute.

ECONOMIC RESULTS.

Pounds of anthracite consumed per hour per indicated horse-power	3·9882
Pounds of anthracite consumed per hour per net horse-power	4·4066
Pounds of anthracite consumed per hour per total horse-power	3·2197
Pounds of combustible consumed per hour per indicated horse-power	3·1308
Pounds of combustible consumed per hour per net horse-power	3·4592
Pounds of combustible consumed per hour per total horse-power	2·5275

WEIGHT OF STEAM ACCOUNTED FOR BY INDICATOR.

Pounds of steam present per hour in the cylinders at the point of cutting off, calculated from the pressure there	4154·6287
Pounds of steam present per hour in the cylinders at the end of the stroke of the pistons, calculated from the pressure there	6559·1121
Pounds of steam condensed per hour in the cylinders to furnish the heat transmuted into the total horses-power developed by the expanded steam alone	851·9174
Sum of the two immediately preceding quantities ...	7411·0295

DISTRIBUTION OF THE POWER DURING THE ABOVE AVERAGE PERFORMANCE.

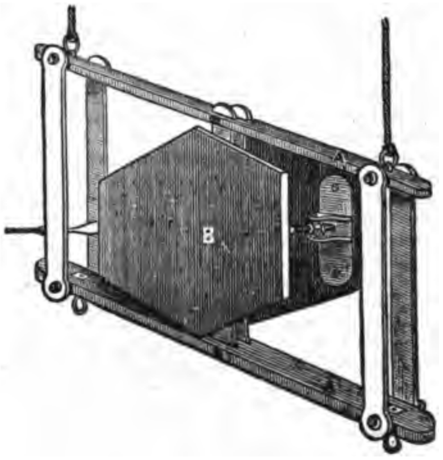
The following is the distribution of the power developed by the engines, calculated as precedingly described, during the above average performance of the *Dispatch*, under the conditions of ordinary practice, in smooth water and uninfluenced by wind or current.

Indicated power developed by the engines	314·2979		
Power expended in working the engines, *per se*	29·8374		
Net power applied to the crankpins ...	284·4605	or	100·0000
Power absorbed by the friction of the load	21·3345	,,	7·5000
Power expended in overcoming the resistance of the water to the screw blades,	20·0675	,,	7·0546
Power expended in the slip of the screw	36·4588	,,	12·8168
Power expended in the propulsion of the vessel	206·5997	,,	72·6286
		,,	
Totals, ...	284·4605	,,	100·0000

ALLEN'S AUTOMATIC SHIP SCRUBBER.

THE necessity for keeping the hulls of vessels clear from grass and other obstruction, is now too well-known to all ship owners to need any special comment from us. But it may be valuable information to them to know that this necessary cleansing can be effected when at sea or when anchored in a tide-way, without going to the expensive process of docking as at present. There are several scrubbers extant besides the one we illustrate, which is the invention of an experienced master-mariner, Mr. Hugh Allen, of 13 and 14, Strand Street, Liverpool, but none have we seen so simple, cheap, and effective in action.

It consists of a jointed frame A, which carries the scrubbing mat and an angle board B, which is pivoted so that it can take any angle with the frame. The tow line is attached to the pivoted brush and angle frame B, so that the frame can be canted independent of the scrubber. Two light hand lines are attached to eye bolts, one at each end of the frame. The principle of the apparatus is that the scrubber is attached by a tow rope reeved through a pulley at the end of the martingale, and the other end being carried on board on to the forecastle. When the frame of the scrubber is canted by the hand lines, the rush of the water pressing on the surface of the inclined frame presses it either up or down, according to the angle of the frame, in the same way as the wind acts upon a kite attached to a string. The angle board B is hinged at one end to the brush mat, and is adjustable at the other end by a screw to an angle of from 15° to 35°. The running water pressing upon this inclined plane, forces the brush mat upon the hull, and is adjusted at a suitable angle to suit a speed of from two to 12 knots.



The scrubber moves when properly adjusted at such a velocity that a brush is soon worn out, and the only thing to stand well is found to be a coir mat.

To work the scrubber, the head-rope is reeved through the pulley at the bottom of the martingale, and the scrubber is thrown overboard with the hand lines attached. One hand holds fast, and veers away the head rope, whilst a second hand attends to the hand lines. The head line is held fast, whilst the scrubber is forced up and down at the bows of the ship by altering the angle of the frame. Then the head rope is slacked out, and another strip is cleaned from the water line to the keel, and so on over the whole hull. A ship 250 ft. long can be thoroughly cleaned on both sides in about eight hours by two men, without interfering in any way with the course of the vessel.

The simplicity of this apparatus, and the thorough manner in which it does its work, are its best recommendations, and from its extremely low price, we do not think that any foreign going vessel should be without it.

REMARKABLE VESSELS.

THERE are now building in the United States two ships. One of these, the dome steamer *Meteor*, is in course of construction at Nyack, on the Hudson. She is the invention of Mr. A. P. Bliven, of Brooklyn, and is being built under his personal supervision. The engines are capable of making 350 revolutions per minute, which gives a velocity of the wheel of over 45 miles per hour, so that it is expected that the *Meteor* will be able to make fully 25 miles per hour, and thus complete the distance from New York to Queenstown or Bristol in a little over five days. The vessel is being built entirely from American materials by American mechanics, and is intended as the pioneer of a class of large steel steamers which will follow in rapid succession. A new feature of the engines is that the high-pressure cylinders are enclosed within the low-pressure cylinders, only two cylinders being visible; and this method will prevent condensation in the cylinder, thus saving all the power of the steam. The vessel will be supplied with a steam generator of the water-tube pattern, which is practically four boilers in one having two smoke stacks, each three feet in diameter, and 20 feet high, four steam safety valves, and four fire grates. The boilers when set up are oval in shape, having 78 square feet of grate surface, 3,560 square feet of heating surface, two centre cylinders of steel 22 inches in diameter and 13 feet long, and 7,850 feet of steel tubing. Every part of the boiler will be tested to 2,000 pounds and inspected to 800 pounds, thus allowing a working pressure of 550 pounds. The *Meteor* will be 156 feet in length over all; length at waterline, 132 feet 6 inches; length on keel, 125 feet 6 inches; depth of hold, 16 feet 6 inches; draught of water aft, 11 feet; tonnage, carpenter's measurement, 512, 33-100. She is the strongest vessel of her size ever built, being constructed of white oak, locust, backmatac, ash, and hard pine. Besides her dome deck she will have a main or spar deck, eight feet below her dome deck, as strong as it is possible to make it. Her interior finish will be in polished hard woods; her saloon, state rooms, officers' quarters, &c., being all finished and fitted up in the best manner alike with regard to beauty as to comfort. Nothing will be seen above her deck except the pilot-house and smoke stacks. Last, but not least, no one need be exposed on a steamer of this type, for in stormy, rough weather she can be closed up perfectly watertight, and driven through and over the heaviest seas without any danger to passengers, crew, hulk, or machinery. A charter has been granted to the New England Quick-transit Steamship Company of Boston, capital 5,000,000 dollars, and they will shortly commence building steel steamers of the above type of 7,000 tons capacity to run between Boston and British and European ports. St. Louis and Chicago capitalists are likewise forming a company, to be called the South Atlantic Quick-transit Line, which will run from Southern American ports to European ports; while a third company, known as the National Construction Company of New York, have purchased a large water frontage and 27 acres of land, adjoining the Manhattan Beach Railroad Docks at Bay Ridge, for the purpose of shipbuilding on a large scale, and after the *Meteor* type.

The second singular vessel in course of construction is the *Oceanic*, now being built at Hastings, on the Hudson. The principle of this steamship is the invention of Mr. Robert Fryer, of New York. It is stated to be a kind of marine velocipede on three wheels, the hull not being intended to touch the water. The most curious point of the invention is that the support of the ship, the float as it were, and the propellers are one and the same. The vessel floats on three spheres, made of sheet steel, one forward and two stern; each of these is fitted with flanges which surround nearly the whole of its circumference and act as paddles. The spheres are so arranged that they can be worked backward and forward, or one worked backward and the others forward simultaneously, so that the vessel may be turned completely round in her own water; and with such a rapid power of turning no rudder will be necessary. The whole vessel is made watertight, so that in the event of the wheels or spheres being broken or disabled, or the vessel capsized, it will still possess sufficient buoyancy to prevent it from sinking. The spheres are provided with a flanged keel, to adapt the vessel for use on rails in case of crossing an isthmus, or for being run upon land for repairs. The ship is designed only for passenger traffic, and it is asserted that its peculiar construction gives increased accommodation, greater safety, and a higher rate of speed than that now attained. The *Oceanic* will be 224 feet long and 130 feet wide, the spherical wheels being 24 feet in diameter, and drawing five feet when loaded. The trial of a small model of the steamer excited great interest recently on the Harlem River, and it travelled equally well on land. The inventor claims that as much difference exists between it and an ordinary boat as between a waggon mounted on wheels and one that should rest on the ground, and be dragged along the surface by means of wheels attached to its sides. The *Nautical Gazette* observes that, if successful, the invention must revolutionise passenger traffic by water, as the vessel for a given amount of this traffic could be built for what the ordinary vessel would cost, and would perform double service. These remarkable developments of shipbuilding certainly promise to make even our swift-going steamers a thing of the past, as the latter have done by the clumsy vessels of half a century ago.

PATENT GAUGE TESTER.

THE importance of accuracy in the indication of gauges cannot be too highly estimated. Many boilers have been over pressed and injured, if not exploded owing to false indications by the pressure gauge. A vacuum gauge is an equally important indicator. If its indications are falsely too high work is being lost without the loss being known. If on the other hand the indication is falsely too low, trouble and expense may be incurred to remedy what was only a supposititious evil.

One of the most perfect and complete instruments that we have seen for the purpose of testing, either pressure or vacuum gauges is that we illustrate, introduced and sold by Messrs. William Reid & Co., of 5, New London Street, E.C.

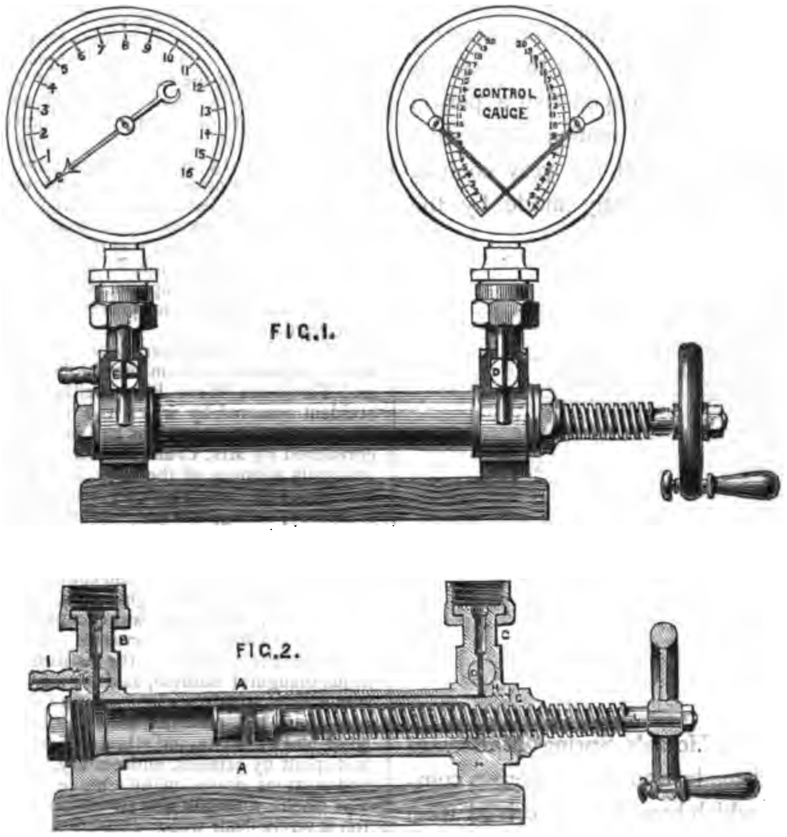
The apparatus consists of a horizontal main cylinder shown in section in Fig. 2. Inside the main cylinder is a working barrel screwed in from one end with a space between itself and the outside shell to allow of free communication to the gauges simultaneously at each end. An air-tight piston is operated in the inner cylinder by a screw and handle. At each end is a screw-nut for attaching gauges, one being for the tested gauge and the other for the control gauge. They can either or both be shut off from the cylinder by plug cocks, and one of them is a three way cock, so that communication can be made between the working cylinder and an external orifice when desired.

The apparatus is supplied with two test gauges, one for pressure up to 300 lbs. per square inch, and the other for vacuum. These test gauges are each duplex and of the most approved construction for reliable indications and good wear.

To test for pressure,—the pressure test gauge is left attached, and the gauge to be tested is attached at the other end. The piston is first screwed home, the three-way cock being turned so as to allow the exit of the air. To the exit orifice I is attached a rubber tube the other end being dipped into water. Both cocks D E are turned so that the passages to the gauges are closed, whilst the communication between the cylinder and the orifice I remain open. The piston is now screwed back so as to fill the piston with water. The three-way cock E is now turned so as to close the external orifice I, and open that to the gauge above, the other cock D being also turned to open the passage to the other gauge. By now screwing the piston inward again the water and air is compressed, and any desired pressure up to 300 lbs. per square inch is easily obtained.

To test for vacuum, after the piston has been screwed home, the external orifice is closed, the gauge passages being open. By screwing the piston out the air is expanded or exhausted, and a vacuum test obtained. If the vacuum is not as much as required the first stroke, let the operation of the piston be repeated, the external orifice being opened for the return stroke, and the gauge passages closed. If the cylinder has been previously filled with water, and then discharged so as to fill the clearance spaces, an almost perfect vacuum may be obtained.

The instrument is beautifully finished and supplied complete, in a handsome mahogany case, at so low a price, that it should be generally adopted.



PATENT GUAGE TESTER.

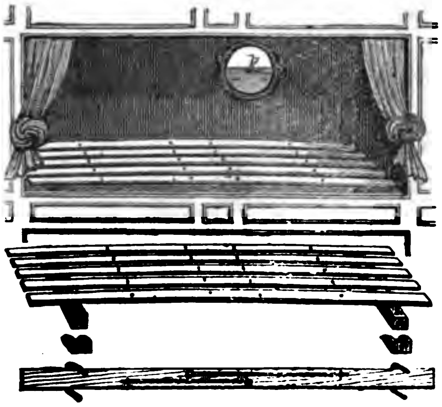
HOWE'S NEW SPRING BERTH BOTTOMS FOR SHIPS AND YACHTS.

As comfortable sleeping accommodation is one of the most appreciable advantages in sea voyages, any important means of adding to this boon will probably be extensively adopted when properly known.

The latest important improvement for this purpose is Howe's Patent Berth Bottoms, an American production which has been introduced for sale in this country by Messrs. Stewart & Co. Limited, of 124, Newgate Street, E.C.

The invention consists of a very simple contrivance, which is a combination of white pine wood laths and steel wire. These mattresses are not only extremely light, clean, dry, comfortable and durable, but are very economical. Indeed the estimation in which they are held in the United States is so great that they are there used on all river steamers as well as in the berths of ships upon several of the Atlantic Steam-ship Lines, where they give great satisfaction, and are much commended.

These patented articles have also been fitted in the berths of several ships on English lines, as well as on board yachts with equal success. The ingenuity and usefulness of such spring mattresses which cannot break when properly used is excellent, and have only to be seen to be at once appreciated.



Several valuable testimonials have been given in favour of this patent invention, including one from Lord Clarence Paget. We are glad to learn from a very praiseworthy statement from Captain Commandant Sadler, of the s.s. *State of Indiana*, that these spring berth bottoms are so easy to sleep upon that a person who uses one can only feel half the motion of the ship. We also think it right to state that the very complimentary notices which were recently made by the newspaper press respecting Howe's Spring Mattresses which are made for bedsteads, and the numerous commendatory testimonials which have been received from among a vast number of persons who have purchased them, will apply equally to the comfort and excellence of the patented spring berth bottoms. In consequence of the keenness of competition for passenger traffic, and the consequent eagerness of Steam-ship Companies to provide all important improvements which they reasonably can for the comfort of their passengers, and the urgent requirement of the latter for all the accommodation which they can secure, it is very likely that within a short time hence, Howe's Patent Spring Ship Berth Bottoms will be in general use, not only in steamships and yachts, but also in sailing vessels for the use of passengers and officers.

NOTES AND NOVELTIES.

SOME Tyne shipowners are complaining of the Government taking up so many "liners" for the conveyance of troops. The grievance has been expressed thus—That vessels belonging to companies that have heavy postal subsidies have been accepted, and thus they have a double benefit, whilst that to the general shipowning trade is less than it would have been.

The Steamship "City of Rome."—It is announced that the claim of the Inman Steamship Company for £140,000 against the Barrow Shipbuilding Company for alleged defects in the construction of the steamer *City of Rome*, delay in delivery, &c., has been amicably settled. It is added that the steamer will change hands, and become one of the fleet of the Barrow Steamship Company, and be employed, as the other ships of the fleet are already employed, in the Anchor Line American services between Glasgow and New York.

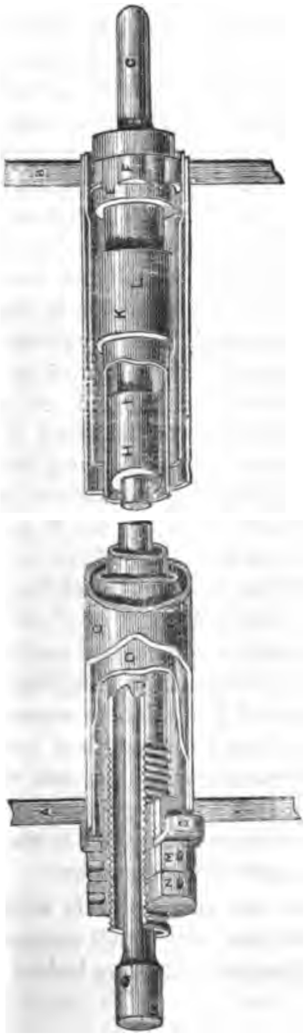
Seven Hundred Miles in a Berthon Boat.—The expedition taken on the 11th inst. by the steamship *Essequibo*, by the kindness of the directors of the Royal Mail Company, safely arrived at Southampton on Tuesday. The party consisted of Captain Harvey, R.N., in command, Captain Whalley Nicholson, and four seamen. They were dropped in a 28-feet Berthon boat 400 miles west of the Land's End, at 10 a.m. on the 14th inst., with a very strong south-west wind and tremendous sea. They arrived at Scilly on the 19th inst., notwithstanding a violent gale of wind, and left there at 4 p.m. on Sunday, and reached the Needles at 3 15 on the 22nd. inst. The weather throughout was very stormy, and the sun was only once seen. This run, for a small boat, is considered almost unprecedented, the speed sometimes exceeding 10 knots an hour. One of the crew, who were all volunteers, was the boatswain saved from the ill-fated *Teuton*. It is impossible to speak too highly of the gallantry of Captain Harvey and Captain Nicholson, who most kindly volunteered their services to prove the perfect seaworthiness of the Berthon boat.

While the new steamer *Clan Macgregor*, one of the Clan Line, was being launched from the shipbuilding-yard of Messrs. Ramage and Ferguson, West Pier, Leith, on Saturday, July 29th, an accident occurred by which the vessel failed to take the water. The necessary preparations had just been made, and the steamer christened by Mrs. Cruickshanks, of Liverpool. The steamer was gradually slipping off the ways, and, when half-way into the water, her progress was suddenly stopped, and the vessel remained stationary, owing, it is said, to the ground beneath her subsiding. The vessel is not supposed to have sustained any damage.

The Institution of Mechanical Engineers.—The summer meeting of this institution commenced in the Civil Court of the Leeds Town Hall on August 15th. There was a large attendance of members. The chair was occupied by the president, Mr. Percy G. B. Westmacott, of Newcastle. The Mayor, Alderman Tatham, welcomed the members of the institution to Leeds. The President, in his inaugural address, said we might pride ourselves upon the vast strides which science, art, and engineering had made in our own time, but posterity would assuredly lay its finger upon the great blot of waste, and stigmatise our age as the black age, which had spoilt by careless, unnecessary, and selfish emissions of smoke and noxious gasses many a noble town and many a lovely spot. The smoke nuisance was altogether inexcusable, and could not be too severely dealt with. Referring to the question of lighting, he said he did not agree with those who believed that electricity would totally eclipse gas. He proceeded: In passing, he referred to a local piece of engineering for the coaling of vessels. On the Aire and Calder Canal, which terminated in the docks of Goole, might be seen snake-like coal trains, propelled by steam, gliding quietly along the course of the canal. These trains were composed of square-shaped wrought-iron barges, vertebrated into one another, and furnished with a cutwater bow-piece in front, and with a steam-propelled compartment abaft. The train of boats is steered by two ropes strung along the sides of the barges from end to end, one end of each rope being fastened to the bow and the other end passing round drums fixed on board the engine compartment. These drums were worked by steam reciprocating gear. On entering the docks the trains were disjointed, and each barge, containing about 36 tons of coal, was brought under a hydraulic hoist, which lifted the barge bodily out of the water, and upset its contents directly into the vessel. Thus the barges are filled from the pit's mouth by gravity, and by gravity again emptied of their contents—a truly complete labour-saving system. May not this system, which was being further developed for flyboats of 130 tons weight, be the precursor of times when the ocean-going steamers might without loss of time on arriving in port be lifted bodily out of the water and then scuttled of their contents, right and left, into warehouses at a rate and with a saving of labour which would far exceed anything hitherto attempted? Alluding to shipping, he said there was perhaps no work that had given more life to our country or had done more to increase our wealth and prosperity than the improvement of river works and the formation of docks, adding that the considerations of economy which is affected by the concentration of effective work upon a definite area of dock, water, and of quay space applied of course with equal force to railway goods sheds and warehouses, and that in this respect they would find, he believed, that in this country they were greatly in advance of the Continent and America. Two papers followed, one by Mr. A. H. M. Thompson, of Leeds, on "The History of Engineering in Leeds," and one by Mr. Charles Cochrane, of Stourbridge, on "The Working of Blast Furnaces of large size at high temperatures."—The afternoon was spent in visiting works in Leeds and the neighbourhood.

MORGAN'S TUBE EXPANDER.

A VERY handy appliance for stopping and expanding leaky boiler tubes is Morgan's Patent, as supplied by Messrs. Wm. Reid & Co., 5, New London Street. An examination of the drawing we furnish will at once explain the construction and indicate the advantages of this apparatus. The appliance is shown ready for use in the boiler tube C, as fixed in the tube plates A, B; A being the smoke-box plate, B, the combustion chamber or back-end plate. D is the inner tube or stopper; E the expander carrying the rollers F; G a mandril for turning the expander. H is a connecting-rod and socket to the mandril, by means of which the end of the tube in the combustion chamber can be expanded from the smoke-box end. J is an adjusting tube whereby the expanding rollers are properly centred, while their position longitudinally is regulated by the nut M. I and L are securing pins, N a check-nut, and O a cap. It will be thus seen that the operation of stopping and expanding the tubes is carried on without drawing the fires or stopping the speed of the ship for one moment; and, when leaking at the back end, without having to send men into the combustion chamber, thus obviating delay and in some cases great destruction to the boilers. As the tubes are made a driving fit at the smoke-box end, the leak there is immediately stopped on inserting the inner tube; there is thus no chance of accidents from scalding. Such a useful and withal simple appliance will no doubt be sufficiently appreciated by engineers.



YACHT VILLA DE SUANCES.—There was lately sent to Spain, for carrying passengers at one of the popular bathing resorts, a smart little steamer, supplied by Messrs. Ross & Duncan, Whitefield Works, Glasgow. The hull of this vessel, we may say, was from the yard of Mr. Thomas Orr, jun., and was admired while in Glasgow harbour for its fine model. The vessel is chiefly noticeable, however, for the very novel type of engines, of Mr. Robert Duncan's design. This engine effects what has long been wanted in steam yachts and launches—the greatest simplicity, economy of fuel, and freedom from liability to get out of order. There are two cylinders set so that the moving parts of each balance the others, and high expansion is got by the steam acting first in a small cylinder and then in a larger one, as in the ordinary compound engine, but with the best possible distribution for economy. The remarkable feature is the steam and reversing gear;—instead of there being four eccentrics, as in the ordinary double-cylinder engine, there is only one which is fixed solid on the crank-shaft. There are no rods, links, quadrants, or wypers to wear slack and give trouble, or cause the disagreeable clacking noise that invariably is heard after the engines have worked a few months, and which, to a very great extent, mars the pleasure of a trip in yachts or launches. The reversing is done by a simple valve arrangement worked by a small handle. The slide-valves are so constructed that they are perfectly balanced, and thus the great waste of power in working the ordinary slide-valve, always a high per centage of the whole work of the engine, is altogether avoided. Practical yachtsmen and steam launch owners will know the advantages of the simplicity and the freedom from liability to get out of order attained in this engine. In the *Villa de Suances*, the boiler is of steel, and is designed for working pressures up to 150 lbs. per square inch, when desired. The trial trip on the Clyde was made in presence of Dr. Thomson, Professor of Engineering in Glasgow University; Mr. Thomson, of the scientific department of Messrs. Denny Brothers, Dumbarton, and several other engineering gentlemen, all of whom expressed themselves highly satisfied with the working of the engines and the rate of speed attained, as the vessel ran very fast with only half pressure, showing her capability for great speed. The propeller is of the "Duncan" form, now coming much into favour for its high efficiency. We have no doubt but next season several yachts and launches will be supplied with Mr. Duncan's engines, and we are convinced that the more widely they are known, the more they will become popular.

SHIPS BUILDING.

THERE is a very large quantity of shipbuilding going on at North Shields at the various yards. Messrs. T. & W. Smith have three steamers, all for local firms, at present on the stocks in various courses of construction. The ship *British Empire*, from Moulmein, was taken into dock, where she will receive a thorough overhaul, and repairs if necessary. At Messrs. Hipple & Co.'s yard, North Shields, there are in construction at present one passenger steamer and tugboat for the River Tyne Commissioners; one paddle steamer for Faversham Navigation Trustees; one cart and horse ferry for Jarrow Corporation; two paddle tugs for Bristol Channel; besides which several steamers are under repair at this establishment. The barque *Eliza Mary* has been under general repairs at Messrs. Young's Dock, North Shields, and will shortly be ready for taking in her cargo. At Messrs. Palmer's yard, at Jarrow and Willington, the men are working overtime, and it is anticipated that they will continue so for the next twelve months. At South Shields the various iron shipbuilding yards are full of work. There being so few wooden ships, very little is doing in regard to that class of vessels. The *Renown* (*s.*), which has been for some time under extensive repairs in Messrs. Brigham & Cowan's yard at South Shields, is now nearly completed. At Messrs. Eltringham's yard there continues a large quantity of work, which will keep the men employed for some months to come. At Messrs. Readhead's yard a vessel was launched this week, and five others are in progress of construction. At Hebburn-on-the-Tyne there are two vessels nearly ready for launching, and two vessels framed. The *St. Andrew's Bay*, built by Messrs. Leslie & Co., will be ready for sea in the course of a few days. The *Boadicea* (*s.*), of North Shields, is alongside the quay at Hebburn, receiving repairs, and the large four-masted steamer *Venetian* is in the dry dock undergoing general repairs.

RECENTLY some large orders have been received for new steamers by the Wear shipbuilders, which will keep the yards well employed during the remainder of the year. The prices for that description of tonnage are now less than they were in the early part of the year.

THE builders of paddle steamers and tugs on the Tyne are at present full of work; the demand for that description of boats continues to increase.

MESSRS. PEARCE BROTHERS' SHIPYARD.—On August 12th, Messrs. Pearce Brothers, Dundee, successfully launched their first ship, and some description of their yard, with particulars of the contracts they have on hand, may not be inappropriate now. Last year the firm resolved to embark in the shipbuilding business, and about October opened negotiations with the Harbour Trustees for the acquisition on lease of 5 acres of the made-up ground to the east of Camperdown Dock. An arrangement was concluded, the price to be paid being 13s. per pole per annum. Craigie Yard was the name given to the ground by the lessees. Contracts were soon obtained, and after Mr. Richard Pearce, the junior member of the firm, had visited the principal shipyards in the kingdom, the plan of utilizing the ground was decided upon. The whole of the buildings, slips, and appurtenances necessary for the trade fell to be erected or provided by Messrs. Pearce. It is intended that ultimately there shall be eight slips, but in the meantime only four have been built, although the excavations for the remaining four have been done. The slips which are available can accommodate vessels up to 3,000 tons. Two additional slips will be ready shortly, and the other two will be proceeded with as required. Then a commodious office, with drawing-rooms, has been set down at the entrance gate. Over the machinery and tools a roof in lattice-girder form has been placed. The machinery embraces what is usually found in shipbuilding yards—punching, shearing, plate-rolling, and plate-planing machines, and a garboard or keel strake bending machine. These are all of the most improved and heaviest description, and the whole are driven by a horizontal non-condensing engine of 150 horse-power. Several of the machines have also separate engines. Underneath the tool shed are the plate and bar furnaces and the steam-boiler. Adjoining is the smiths' shop, containing 16 fires and two steam-hammers both 2-feet stroke. The furnaces are all cast-iron and portable. Still further east, and separated from the other buildings, are stores for oil, paint, and other inflammable material. Running along the western boundary is the carpenters' and joiners' shops, the tools in these being of the most approved make of Ransome & Company, London. The customary racks for wood and buildings for stores, &c., complete the yard, which is a model of completeness and suitability for the business to be carried on. The vessel launched was built to the order of the Ayrshire Steam Navigation Company, Limited, Messrs. John Smith & Son, Ardrossan, being the managing owners. The dimensions are—length, 200 ft.; breadth, 29 ft.; and depth, 13 ft. 9 inches. Her engines are of 23 and 45-inch cylinders, by 30 inches stroke, and are high and low pressure surface condensing, 90 horse power nominal. The vessel, which has an upright stem and eliptical stern, is classed 100 A 1 Lloyd's, will carry 1,100 tons, and is intended for the Bilbao trade. She is a cargo boat, and will be schooner rigged fore and aft. Other three vessels are in course of construction. One of them is a duplicate of the one launched, but with passenger accommodation. The other two are somewhat smaller. The next to be launched is for the Compagnie Nantaise, of Nantes, and the other two are to the order of Messrs. Robert Thomson & Company, Mark Lane, London. The French vessel will, it is expected, be launched in five weeks. The Messrs. Pearce have received orders for six additional vessels of about the same size as those now on the stocks.

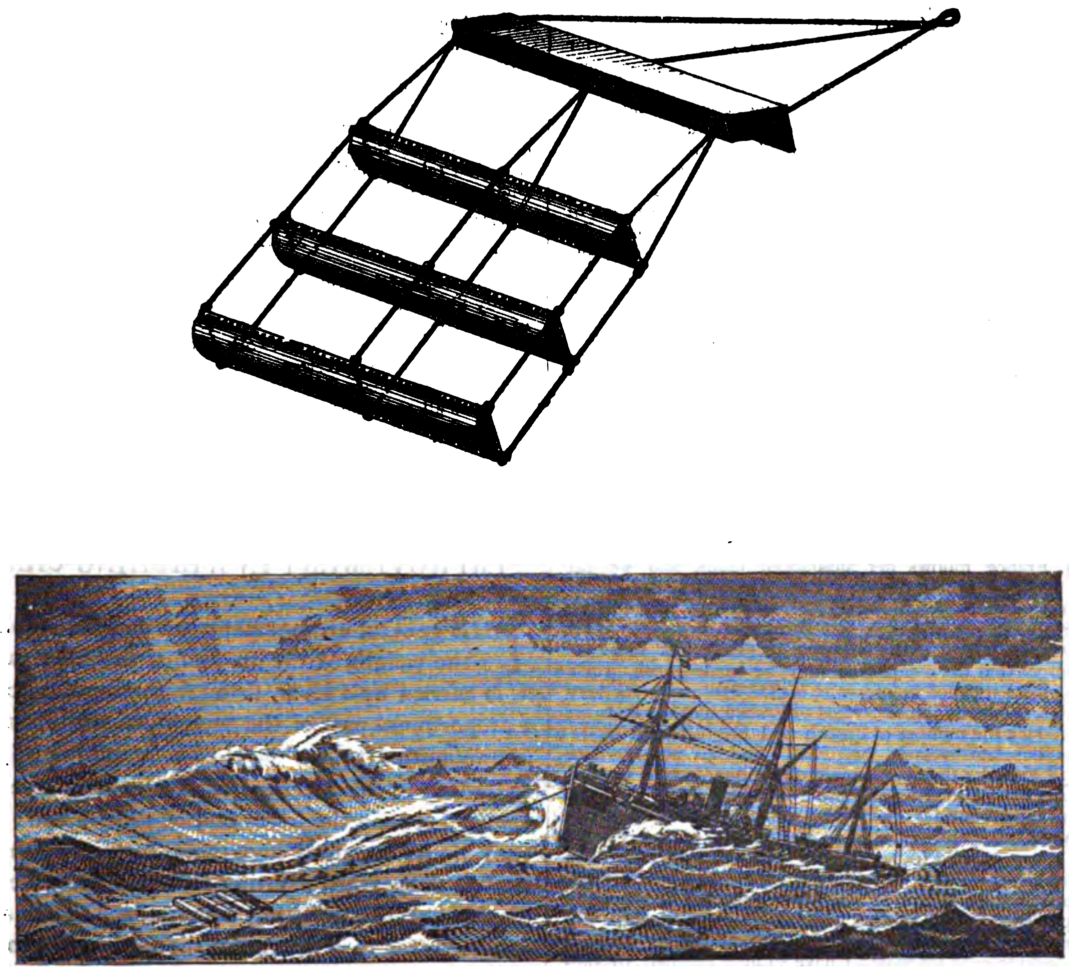
MESSRS. HODGSON & SOULSBY, of Blyth, have now in hand five vessels, one of which is launched, another about to be launched, and the other three are well advanced. At the Co-operative Shipbuilding Company's dock at Blyth there is a considerable quantity of work in hand.

BULLIVANT'S SEA-ANCHOR.

THE value of a floating drogue or sea-anchor for holding a vessel head to wind in a heavy sea is now generally recognized. Messrs. Bullivant have as usual, applied their ingenuity and energies to produce an improved sea-anchor to meet the requirements of the market. The result we illustrate herewith. The apparatus is an excellent combination of great lightness and great strength. The lightness is necessary to render it capable of floating with ease and at the same time, strength is equally an obvious necessity. The steel-wire rope attachments, as specially made by this firm, confer exactly these qualities. The floating portion of the sea-anchor is formed by raft or float of wood well seasoned and caulked, or of iron or steel. The bags, which take excellent hold of the water, are attached by means of shackles and Patent Steel Wire pendants, to eyebolts at the back of the raft, and are connected to each other by short patent steel-wire pendants and shackles. The bags are stretched on a bar-iron rim at the mouth of each bag, stiffened with a cross-bar of iron in the centre of each. The float is also provided with a vertical flap one foot in depth, to give additional resistance to dragging. The float has sufficient power of floatation to support not only the anchor, but the requisite length of towing steel hawser, and the dimensions of the raft and drogues are varied to suit small or large vessels, being kept as nearly as possible in equal rates to the towing resistance of the vessel at various speeds.

The form of the sea-anchor is evidently specially adapted to fold into very small compass, the bags all closing up to the raft and being lashed there when not in use.

Besides the value of this sea anchor as a drogue, it may serve many other useful purposes on board. If the rudder is disabled, it may be placed astern without the bags, and can be worked as a temporary rudder with a span across to each quarter fitted with the necessary tackle. As much attention is now being justly paid to devices for saving life at sea in sudden emergencies, it may be pointed out that two rafts or floats connected by spars would provide a most efficient life-preserver to a whole crew, the eyebolts affording the readiest possible means of attachment for such a purpose. A single raft would suffice to save several lives. On a lee shore, too, a raft without the drogues would form a most useful means of communicating with the land, by carrying ashore a steel hawser. The sea anchor would soon save its own cost by enabling a heavily laden steamer to bank her fires, and lie easily, head to wind, in a heavy head sea, through which, otherwise, she would have constantly to force her way at considerable expenditure of fuel to prevent broaching to.



BULLIVANT'S SEA ANCHOR.

Reviews.

Our Great Peril if War overtake us, with our Fleet Deficient in Number, Structure, and Armament. By Admiral Thos. M. C. Symonds, London; W. Kent, 23, Paternoster Row.

This interesting little pamphlet, by so well-known an authority as Admiral Symonds, is well worth the attention of our readers.

Admiral Symonds commences by quoting the opinion of the late Prince Consort, who has always been considered a wise and ar-seeing man. His opinion was that "It is a perfect disgrace to our country, and particularly to our Admiralty, that we can do no more than hobble after the French, turning up our noses proudly at their experiments and improvements, and when they are established as sound, getting horribly frightened, and trying by wasting money to catch up lost time, and all the while running serious risk of security." A dreadful picture is drawn by a French Admiral as to the probable results of a future war with France should our Navy be over-powered.

"Admiral Aube truly says that we have already had to retreat from our just demands 'before the threat of war carried on by cruisers against our commerce.' He declares that in any future war the French 'will come down from the heights of that cloudy sentimentality which has created the monstrous association of words—*rights* of war (*les droits de la guerre*)—and the attack on every source of our riches will become not only legitimate but obligatory upon them; and if they gain any temporary command of the Channel, every power of attack and destruction will be employed against all our littoral towns—fortified or unfortified—whether purely peaceful establishments or warlike—to burn them, destroy them, or at least to pitilessly ransom them!'

"What a picture of possible destruction is here, of Brighton, Worthing, Ventnor, Bournemouth, Torquay, and a hundred other peaceful towns on all our coasts! And are we not bound in common prudence to take care that we have ready those ships which would make such havoc impossible? Have we those ships, or are we likely to have them? Let us look at what the French Navy and our own will be in 1885,—if *they* fulfil their present building programme, and *we* go on building at our present rate."

Admiral Symonds fears that the revolution of steam in the navy will have destroyed much of our old skill and prestige. He says:—

"We shall never again have that advantage of greatly superior skill, and ever growing prestige, which made victory so often ours in sea fights during the Napoleonic war; for steam has made good seamanship less necessary now than it then was. None could have fought more bravely than the French did: but their men, from being kept in harbour by our blockades, were unpractised (often actually sea-sick); and their older officers had been scattered by the Revolution. Heaven, too, had raised up for us Nelson—a rare combination of perfected nautical skill, with the intuition of genius—our ships also outnumbered theirs as two to one. So that we could shut up their fleets in harbour, and scour every sea and protect all our coasts. Yet notwithstanding our vast superiority at sea, a descent on Ireland was possible, and the loss to our commerce was great, and marine insurance was ruinous.

"In any future war between England and France—which may God in his mercy forfend!—superior seamanship will avail us little on board Ironclads; and we shall have (unless we very greatly increase our yearly building) no numerical superiority—nay, it will be inferiority, as many of *our* ironclads *must* be in distant climes, whilst all the French can be always at home. So we shall be madly foolish if we do not at once and largely add to our ironclad fleet and unarmoured cruisers."

Admiral Symonds then compares the respective fleets of France and England, very much to our disadvantage, thus:—

"A comparison of the two fleets in battle array as they will be in 1885 (if France follows her announced plans, and we do not greatly increase ours), shows a French Grand Total of 61 vessels against our 60. When some of her ships will be as much more powerful than any of our present ships (the *Inflexible* alone excepted) as was a line of battle ship to a frigate. Nor must we altogether forget that the comparison may be made much worse for us, if—as has happened before—the Italian fleet, with its very powerful ships, should be joined to that of France, making 80 to 60.

"If you reduce the number of French and English ships by deducting the obsolete vessels, we shall find 40 non-obsolete English to 38 French; deducting again objectionable and wooden ships, we have left 30 for England and 29 for France.

"But if we also consider quality as well as numbers, the comparison is much more unfavourable to us; for 15 of the French ships, with 4 now ordered to be built, or 19 in all, will then have every improvement. These 19 will carry guns over 38 tons, while only nine of our ships will do so: all these guns will be the more handy and powerful breech-loaders, while allbut 15 of our ships will carry only muzzle-loaders. Many of the French vessels too will carry the broadside guns for which I have so long pleaded to supplement their *few* large guns. The 19 French vessels will be divided fore and aft into small compartments, so that they will not be sunk or water-logged by the filling of one compartment when pierced: 15 only of the English ships will be so divided, and of them, the *Dreadnought*, *Alexandra*, and *Temeraire* are so divided only in part. Our *Devastation* and similiar vessels, *Hercules* and the like, I hold to be unfit to go into action till so divided, for one blow of shot, shell, ram, or torpedo near to or under water would probably send them—crew and all—to the bottom like the *Rè d'Italia*."

Some very good advice is given as to the present failure of our system of training young sailors and gunners, with the following results:—

"Of our officers and men I am heartily proud: they will, I am sure, be found more than equal to any whom they may have to meet. Perhaps a little stricter discipline, a little less of the shore, more practical knowledge of steam, of the ships belonging to Foreign Navies, and of foreign languages (especially of French) is desirable.

"Our seamen gunners, and our young men after training should not—as now—waste their time in harbour and in our reserve ships, but should both, for their perfecting by practice, be placed on board six steam corvettes, with Rear-Admiral, Captains, and a large staff of officers yearly changed, for exercise in war manœuvres under steam (with as little as may be of sail shifting), and for practice in gunnery, torpedoes, and boat-work.

"My own conviction is that our men are too long in the coastguard, and I have grave doubts of the R.N.R., as I much fear that very many of them would not be forthcoming when really wanted for a war.

"I think it would improve and strengthen our Navy, if the carriage of all troops, navy stores, coal, &c., were performed by it, its officers and men gaining thereby useful experience: and the building of long coal carrying steamers would give a class of vessels greatly needed by our Navy. During war merchant ships with ordinary merchant crews could not compare with such vessels officered and manned by our Navy."

To this summary and descriptive pamphlet are added a mass of interesting letters from the same author on cognate topics and also detailed lists of the ships and condition of the French and English names for comparison, some of which we have already published.

Altogether we cannot but recommend this pamphlet to all Naval officers to give them an excellent idea of their possible foes, and a true and relative estimate of the powers of offence and defence of their own vessels.

Particulars of Dry Docks, etc., on the Thames. Compiled by Charles H. Jordan, M.I.N.A. London: E. and F. N. Spon. 1882.

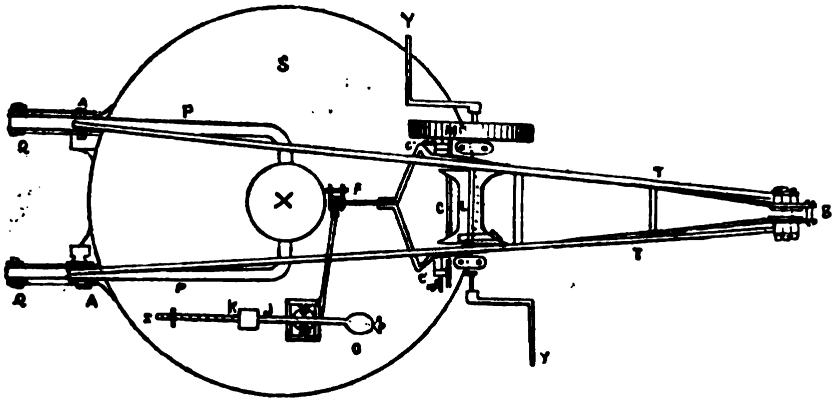
This is a useful little compilation, printed on a folded sheet in a handy form for the pocket. On it we find a clean and accurate map of the River Thames from London Bridge to the proposed Dagenham Docks, showing the network of railways and docks which line both sides of the waterway. The position of the Dry Docks and Gridirons are specially laid down, while a comprehensive table furnishes all necessary information as to size, entrance, height of sill, construction, and so forth. The proprietors' names and addresses are appended, with instructions as to how each dock is reached from the City. All river-side officials and shipowners should find this little work indispensable in their offices.

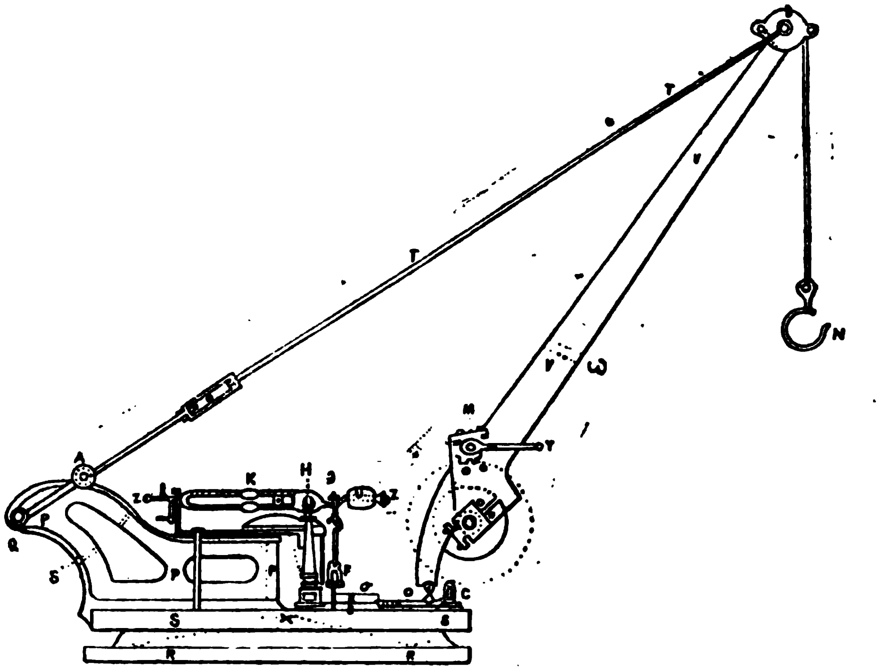
IMPROVEMENT IN WEIGHING CRANES.

THE general arrangements of this invention is that the weight of the jib. and of the load raised by it, is carried by a lever, through the medium of which a proportional part of the weight of the jib and load is transmitted to the steel-yard weighing apparatus, according to the leverage of the various levers intervening between the lower end of the jib and the steel-yard of the weighing apparatus, instead of the entire load to be weighed exerting its effect upon the table or platform of the weighing apparatus. This arrangement reduces to a minimum the fatigue on the knife edges.

The weighing apparatus and the lever supporting the jib are carried on the turning plate or table of the crane when the crane is a rotating one, or upon the sole plate or ground when the crane is not adapted to rotate. The upper end of the jib may be supported by tension-rods from a tail-frame in the usual way, or otherwise.

Plate, Fig. 1 is a plan, and Fig. 2 an elevation of a crane constructed to meet these requirements for weighing on the steel-yards. A A are the lower points of attachment of the tens on rods T; B B the upper points of attachment of same; C, crosspiece or axis of the triangular lever; C', flat-bearing surfaces, forming friction-less abutments for the two sides, V V, of the jib; D D, knife edges, forming points of support; E, the knife-edge of the triangular lever; F, shackle of the suspension rod; G, knife-edge of the short arm of the steel-yard arm; H, knife-edge forming the fulcrum of the steel-yard arm; J and K, small and large sliding weights; L, the chain drum; M, the driving pinion; N, hook for attachment of the weight to be raised; O, regulating screw for tension rod; P, cast iron tail-frame; Q Q, points of attachment for the links of the tension rod; R, base plate; S, turning plate; T, tension rod; U, counter-weight of the steel-yard arm; V, the jib; X, the pivot of the platform; Y, the crank handle; *Z*, the steel-yard arm, graduated according to the weights employed.





The object then being placed on the hook N is raised by the crank handle Y, and when suspended exercises a pressure on the jib V. This pressure is transmitted successively through the various parts of the apparatus by means of the various knife edges to the steel-yard X, which is balanced by moving the weights J and K further from or nearer to the fulcrum, according as the load is more or less heavy, the positions of these weights on the steel-yard arms indicates the weight of the load.

This weighing apparatus is adapted for use in hand, steam, or hydraulic cranes.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Moss Brow.—On July 29th, Messrs. Turnbull & Son, Whitby, launched a vessel from their premises, which was christened *Moss Brow.* by Mrs. Walter Pyman, of Moss Brow, Whitby. The vessel, which has been built to the order of Messrs. Pyman Bros., London, is of the following dimensions:—Length, 260 ft.; breadth, 35 ft.; depth of hold, 19 ft.; class at Lloyd's, 100 A 1. She is built with raised quarter-deck, bridge, and topgallant forecastle, and with double bottom throughout, on the cellular system. Her engines are by Messrs. Blair & Co., Stockton, and patent windlass by Messrs. Emerson, Walker & Co., London.

Bancan.—On July 29th there was launched from the Howdon Yard of Palmer's Shipbuilding and Iron Company a screw steamer, built to the order of Messrs. D'Aubigny & Co., La Rochelle, France. Her dimensions are:—Length, 250 ft.; breadth, 33 ft.; depth of hold, 16 ft.; carrying capacity (deadweight), 1,650 tons. The engines will be 180-horse power nominal, the cylinders being respectively 30 in. and 57 in. in diameter, and the stroke of the piston 36 in. The steamer has been built to take the highest class at Lloyd's. She will be rigged as a two-masted schooner, and will have a long raised quarter-deck, in which will be accommodation for the captain and officers. The vessel was named the *Bancan.*

Taygete.—On July 31st, from the yard of the Barrow Shipbuilding Co., there was launched an iron two-masted schooner-rigged steamer named the *Taygete*, of 1,870 gross tons. She has been built to the order of Messrs. Fraissinet & Co., Marseilles. Her dimensions are:—Length, 260 ft.; breadth, 35 ft. 9 in.; depth, 23 ft. She has one pair of compound inverted direct acting surface condensing engines, with cylinders 36 in. by 63 in., and 48 stroke—working pressure 75 lb., with two boilers 12 ft. in diameter by 15 ft. long, and eight furnaces 3 ft. 9 in. in diameter. Engines 175 nominal horse power.

El Dorado.—On July 31st there was launched from the yard of Messrs. T. & W. Smith, North Shields, an iron screw steamer named the *El Dorado*, built to the order of Messrs. Scrutton & Co., of London. She is of the following dimensions:—Length, 240 ft.; extreme breadth, 34 ft.; depth, 17 ft. 5½ in. The steamer is classed 100 A 1 Lloyd's, and is 1,350 gross tonnage.

Ville de Ceara—On August 1st Messrs. Schlesinger, Davis & Co. launched, at Wallsend, a screw steamer named the *Ville de Ceara.* Her dimensions are as follows:—Length between perpendiculars, 285 ft.; breadth of beam, 37 ft.; depth of hold, 26 ft. 9 in. She is intended to receive the highest class in Lloyd's Registry. Her cabin accommodation for passengers, mails, &c., will be under the spar deck. Arrangements are made for carrying about 300 emigrants in 'tween decks. Her engines will be fitted on board by Messrs. R. & W. Hawthorn, of Newcastle. The *Ville de Ceara*, like her sister-ship *Ville de Para*, has been specially constructed for the mail and passenger service, and is owned by La Société Postale Française de l'Atlantique of Havre and Paris.

Resolven.—On August 1st Messrs. John Cory & Sons, of Cardiff, added another screw steamer to their fleet. The launch took place at Jarrow-on-Tyne, from the iron ship-building yard of Messrs. Palmer & Co. As the ship left the ways she was named the *Resolven.* She is fitted with steam steering gear, Emerson, Walker & Co's. patent combination windlass, and has all the most recent improvements for despatch in loading and unloading cargoes. She has been built under the superintendence of Captain Kidd, late master of the screw steamer *Rokeby.* The following are the dimensions of the ship:—Length, 275 ft.; beam, 36 ft.; and depth of hold, 19 ft. Her engines, which are on the compound surface-condensing principle, of 190-horse power, have also been constructed by the same company.

Wellfield.—On August 1st, Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Messrs. R. Ropner & Co., of West Hartlepool. Her principal dimensions are—Length, b.p., 275 ft.; beam, extreme, 35 ft. 6 in.; depth, moulded, 21 ft. 2 in. She is built to Lloyd's highest class, and has short poop, long quarter-deck, and bridge-house, with topgallant forecastle extending to the foremast, and water ballast under each hold; the decks, masts, chart-house, engine skylight, and cabin companion are of iron. She will be fitted with four hatches and steam-winches, Emerson, Walker & Co's. patent windlass, and will be rigged as a double top-sail schooner. Engines of 200 nominal horse-power will be supplied by Messrs. T. Richardson & Sons, of Hartlepool. This vessel is No. 110 in the builders' yard, and the third built by them for the same owners. On leaving the ways the steamer was christened *Wellfield* by Miss Amy Ropner, daughter of the principal owner.

Benwell Tower.—On August 1st an iron screw steamer, built for Messrs. Stumore, Weston & Co.'s Tower Line, was launched from Messrs. Wigham, Richardson & Co.'s yard at Low Walker-on-Tyne. The extreme dimensions are:—Length, 310 ft.; breadth, 37 ft. 3 in.; depth, 29 ft. moulded. She is classed 100 A 1 at Lloyd's under special survey, and will carry a passenger certificate; her hull, machinery, boilers, and outfit being under Board of Trade survey, and to their requirements for passenger steamers. The cargo holds are of a cubic measurement capacity of 4,250 tons, exclusive of 250 tons of permanent bunker space. The total deadweight carrying capacity is 3,600 tons. The frames are carried up, plated over, and decked in for a length of 80 ft. amidships, forming a protection to the engine-room and stoke-hole casings, officers' rooms, &c., in heavy weather. Steam steering gear is fitted in the bridge wheelhouse and powerful screw gear in the after wheelhouse, Chadbourn's reply telegraph being fitted from the bridge to both after wheelhouse and engine-room. The cargo hatches are worked by four large horizontal steam winches, and both anchors by a powerful crane, and Emerson Walker's patent steam windlass. A saloon, with accommodation for 20 first-class passengers, is fitted up in an iron deck-house aft, and communication with the 'tween decks arranged, so that a large number of passengers could be accommodated should the ship be employed in the passenger service. The engines are compound, and by the builders of the ship. Diameter of cylinders 35 and 70 in.; stroke of piston 48 in., indicating 1,300-horse power, and supplied by steam, at 80 lb. pressure, from two large double-ended steel boilers. The ship takes her name from Benwell Tower, the Bishop's palace, presented to the new See of Newcastle by Mr. Peace, the Newcastle banker.

Mexican.—On August 1st there was launched from the shipbuilding yard of Mr. James Laing, Deptford, Sunderland, the largest steamer built on the Wear. The launch, which was a highly-successful one, was witnessed by several thousands of persons, who lined the banks of the river and other places where a good view could be obtained. The vessel, which was christened the *Mexican* by Mrs. Paget, was built specially for the Royal Mail service carried on by the Union Steam Ship Company between this country and the Cape Colonies. This addition to their fleet is the forty-first vessel which has been purchased by them for their mail service during the past twenty-six years. She is one of the handsomest of this already fine fleet, and by the dimensions given below it will be seen that she is by far the largest vessel yet built for the Cape mail service. Her dimensions are—Length, 392 ft.; breadth, 47 ft.; depth, 33 ft. 8 in.; estimated gross tonnage, 4,590, with a displacement of 8,000. She has the unusual number of 21 bulkheads, 7 of which extend to the upper deck; she is divided into 30 watertight compartments, and has a double bottom constructed on the "cellular system," extending the whole length of the ship, and capable of containing 570 tons of water as ballast. The *Mexican* has present accommodation for 176 first-class, 164 second-class, and 100 third-class passengers, which can be further increased if required. The sleeping cabins, owing to the width of the ship, are unusually large; wire-wove matresses and Smith's patent lavatories are fitted throughout, and no expense has been spared to ensure the comfort of the passengers. The baths are of marble, by Walker & Emloy, of Newcastle-on-Tyne; tesselated pavement and ornamental tiles are used in the bath-rooms and lavatories, and special attention has been paid to the sanitary arrangements. The whole of the main-deck bath-rooms and 'midship cabins are ventilated by Mosse's and Mitchell's patent automatic ventilators, which are now fitted in most of her Majesty's troopers. Two large cooking ranges are supplied by Benham, of London, which are provided with every possible fitting required to meet the demands of so many passengers, and the varied *menu* for which this company is noted. The unusual number of eleven boats is carried, six of which are lifeboats. The engines are made by George Clark, Southwick Engine Works, Sunderland. The cylinders are 50 in. and 94 in., with a stroke of 54 in.; the crank shafts and propeller are of steel, and manufactured by Vickers, of Sheffield; the boilers, which are built of steel, are of great size; they are three in number, double ended, that is to say, equal to six ordinary boilers; have Foxe's patent corrugated furnaces (18 in number), 10,000 square feet of heating surface, and a working pressure of 90lb. The ship is rigged with three masts, and carries a very large spread of canvas, her foreyard being 92 ft. long, and constructed of steel. When completed she will be placed on the service, and will prove a valuable addition to the already splendid fleet of this company. In 1877 Mr. Jas. Laing launched from his yard the steamer *Durban* for the same company, which at that time was one of the largest vessels in the trade. After the launch a luncheon was held in the offices of the firm, when there was a numerous company present.

Advance.—On August 2nd there was launched from the Commercial Graving Dock, Cardiff, an iron screw steamer of 85 tons gross register, named the *Advance*, of the following dimensions:—Length, 90 ft.; beam, 18 ft.; and depth of hold, 9 ft. She is classed 100 A 1 at Lloyd's and for Board of Trade passenger certificate. The steamer has been built for towing and trawling, and her cabin affords accommodation for passengers. The vessel is fitted with a powerful steam windlass (Messrs. Emerson, Walker, & Co.'s Patent) forward, and the arrangements of deck and bridge are excellent. The steamer has been built and engined by the Tyneside Engine Works Company (Limited), Bute Docks, Cardiff, to the order of Messrs. W. & H. R. Strong, of Stuart-street, Cardiff, under Mr. R. H. Strong's superintendence. The *Advance* is the second vessel built by this company, but is the first screw tug-boat they or any other local firm have constructed for the port.

Glenorchy.—On August 2nd there was launched by the Sunderland Shipbuilding Company, the *Glenorchy*, a sailing ship, constructed by the company to the order of Messrs. Macintyre & Co., of Liverpool, and under the superintendence of Captain Malcolmson, the Surveyor, employed by the firm, and Mr. Williamson, Local Surveyor for Lloyd's. The dimensions are:—Length, 285 ft.; breadth, 42 ft.; and depth 25 ft. 2 in. She is of extra strength, will be classed A 1 at Lloyd's, and will be rigged as a four-masted sailing ship, having yards on three or four of her masts. The gross registered tonnage is 2,400 tons, the deadweight capacity of the vessel being about 3,400 tons. The ship is intended for the East Indian trade.

Vito.—On August 2nd Messrs. Caird & Purdie launched from their yard at Barrow-in-Furness a steamer 240 ft. by 30 ft. by 17 ft. 2 in., constructed to meet the highest requirements of Lloyd's. The vessel has been built to the order of Messrs. James Jack & Co., for Messrs. John Glynn & Sons, of Liverpool. The engines are upon the compound principle, of 700 horse power indicated, with boilers of steel, working at a pressure of 95 lb. The hull and machinery have been built in accordance with the specifications of Mr. George Hepburn, consulting engineer. On leaving the ways, the vessel was christened *Vito*, by Miss Jack, daughter of Mr. John Jack, of Prince's-park.

Camma.—On Aug. 3rd Messrs. M. Pearse & Co., launched from their iron shipbuilding-yard, at Stockton, an iron screw steamer of the following dimensions:—Length between perpendiculars, 200 ft.; breadth, moulded, 30 ft.; depth, 13 ft. 11 inches. She is about 840 tons gross register and will carry about 1,100 tons deadweight. She will obtain the highest class at Lloyd's under their special survey, and has been built under the inspection of the owner's marine superintendent, Mr. J. R. Fothergill. She has a topgallant forecastle, and will be rigged as a two-masted schooner, with two yards on her foremast. Her engines are compound, of 90 horse-power nominal, from the firm of Messrs. Blair & Co., (Limited), of Stockton. The steamer has been built for Mr. F. Herkind, of West Hartlepool, and as she left the ways received the name of *Camma*.

Thornycroft.—On August 3rd Messrs. Wm. Gray & Co. launched from their yard at West Hartlepool an iron screw steamer of the following dimensions:—Length between perpendiculars, 257 ft. 6 in.; breadth, 35 ft. 6 in.: depth, 19 ft.; built to the order of Messrs. Murrel & Yoeman, of West Hartlepool. The engines, of 150 horse-power, are being supplied by Messrs. Blair & Co., Stockton. And Patent Windlass by Messrs. Emerson, Walker & Co., London. On leaving the ways the vessel was named the *Thornycroft*. The christening ceremony was performed by Mrs. F. Yoeman.

Kingdom.—On August 4th Messrs. Boxford and Sons, Sunderland, launched from their yard a screw steamer, called the *Kingdom*, to the order of Messrs. Wm. Thomas & Co., 30, Brunswick-street, Liverpool, of the following dimensions:—Length, 280 ft.; breadth, 36 ft.; depth, 24 ft. 6 in., and about 3,000 tons burthen; and built to the highest class at Lloyd's. She is intended to be employed in the American and Indian trades.

Holderness.—On August 5th there was launched from Earle's Shipbuilding and Engineering Company's yard a steamer intended for the Baltic and Mediterranean trades. She has been built to the order of the Holderness Steam shipping Company, Limited, of which Messrs. Moran & Sanderson are the managers. The vessel was named the *Holderness* by Miss Jameson, daughter of Mr. R. Jameson, Eastella House. The *Holderness* is of the following dimensions:—Length, 255 ft.; breadth, 34 ft. 6 in.; depth of hold, 17 ft. 6 in. She will be propelled by engines of 150 horse-power nominal, also constructed by Earle's Company.

Klyde.—On August 14th Messrs. C. S. Swan & Hunter, Wallsend, launched an iron screw steamer, 256 by 35 by 18, built to the order of the Klyde Steamship Company (Limited), Messrs. Thos. Hunter & William Jacks, managers. The vessel was named the *Klyde* by Mrs. Thomas Hunter, and is intended for the Black Sea and general trades. She will be fitted with engines of 160 horse-power, by the Wallsend Slipway and Engineering Company (Limited).

Noord Braband.—On August 14th there was launched from the shipbuilding-yard of Messrs. Raylton Dixon & Co., Middlesbrough, a screw steamer, destined for the mail service between Rotterdam and Java. Her dimensions are:—Length over all, 310 ft.; breadth, 40 ft.; depth of hold, 23 ft. 9 in.; and she will carry a deadweight of about 3,650 tons. She is built with water-ballast throughout on the cellular principle, has iron decks (the upper laid with teak), full poop aft for the accommodation of 20 first-class passengers, and the second-class in forecastle, and having accommodation for her officers, &c., under long bridge, amidships. She has steam steer-gear, and all the latest improvements. This vessel, which is the seventh built by Messrs. Raylton Dixon & Co. for the same service, between Rotterdam and Java, on leaving the ways was christened the *Noord Braband* by Miss Maud Mills, the daughter of the inspector for the owners.

Hatfield.—On August 15th an iron screw steamer was launched from the building-yard of Messrs. W. Gray & Co., West Hartlepool, of the following dimensions:—Length, 268 ft.; breadth, 36 ft.; depth of hold, 19 ft. 9 in. She is classed 100 A 1, the highest class at Lloyd's, built to the order of T. S. Hudson, Esq., of West Hartlepool, and intended for the American or Indian trade, to carry 2,630 tons dead weight. She has a poop aft fitted up for the accommodation of captain and officers, raised quarter-deck, bridge over engines, and a topgallant forecastle for crew. The vessel is supplied with four steam winches for loading a discharging cargo, and is fitted with Messrs. Emerson & Walker's patent windlass and steam steering gear amidships. Her engines are built by Messrs. Blair & Co. (Limited), Stockton-on-Tees, and are of 180-horse power nominal. This ship has been built under the inspection of Captain Staniland, of Hartlepool, Mr. Hudson's superintendent, whose wife performed the christening ceremony. This is the sixth vessel that this firm have built for Mr. Hudson, and they have another in hand. On leaving the ways she was christened *Hatfield*.

Victory.—On August 15th Messrs. Richardson, Duck & Co. launched from their South Stockton iron shipyard an iron screw-steamer of the following dimensions:—Length over all, 334 ft.; breadth, extreme, 38 ft. 3 in.; depth in hold, 25 ft. 6 in.; gross tonnage, about 2,860. This steamer has been built to the order of Messrs. Macintyre Brothers & Co., of Newcastle, and is classed at Lloyd's 100 A 1 special survey, but she is in many respects considerably in excess of Lloyd's requirements. The engines, by Messrs. Blair & Co., Stockton, are 300 horse-power. She will be rigged as a brigantine, and is specially designed for the Atlantic grain and cattle trades. As the vessel was leaving the ways she was christened the *Victory* by Mrs. Macintrye, of Ryton-on-Tyne. She will be fitted out under the superintendence of Captain Elcoate, by whom she will be commanded.

Glen Dochart.—On August 15th Messrs. Schlesinger, Davis & Co. launched from their yard, at Wallsend-on-Tyne, an iron screw steamer of the following dimensions:—Length, 235 ft.; breadth, 32 ft.; and 18 ft. depth of hold. She was named *Glen Dochart*, and has been built for a new partnership of managing owners, Captains Thomas M'Nabb and W. M. Young, of Newcastle-on-Tyne.

Glenochil.—On August 16th Messrs. J. L. Thompson & Sons, Sunderland, launched to the order of Messrs. Lindsay, Gracie, & Co., Newcastle-on-Tyne, an awning-decked steamer, of about 4,300 tons measurement capacity. Her dimensions are 296 ft. 6 in. extreme length, 37 ft. beam, 29 ft. depth to awning-deck. She was named the *Glenochil* by Mrs. Lindsay.

THERE has been launched from the yard of Messrs. Palmers' Shipbuilding and Iron Company (Limited), at Jarrow, an iron screw steamer of the following dimensions:—Length, 286 ft.; breadth, 37 ft.; depth of hold from top of water-ballast-tank to upper deck, 23 ft. 2 in. The vessel has been built for the Steamship Carlisle Company (Limited).

LAUNCH.—Scotch.

Limpet.—On August 15th there was launched from the shipbuilding-yard of Messrs. Barclay, Curle & Co., at Whiteinch, a steamer—dimensions, 200 by 25 by 12.10, and 100 horse-power—built to the order of Messrs. G. & J. Burns, and intended for their Irish trade. As the vessel left the ways she was named the *Limpet.*

Kawatiro.—Messrs. H. M'Intyre & Co., launched from their shipbuilding yard this iron screw steamer, of 750 tons, built to the order of the Westport Colliery Company of New Zealand. The engines are being made by Messrs. Fleming & Ferguson, Paisley. The steamer is the first of three the builders have on hands for the same owners. The third steamer is the hundredth contract Messrs. H. M'Intyre & Co., have concluded since commencing business a little over five years ago, and the *Kawatiro* is the ninetieth vessel launched.

Westfalia—On July 20th, Messrs. William Hamilton & Co. launched from their building-yard at Port Glasgow, a steel screw steamer of 1,200 tons gross register. This steamer has been built to the order of Messrs. Walker, Donald, & Co., of Glasgow, for their Spanish and Mediterranean trade, and has been specially designed to carry a large cargo on a light draught. She has water ballast fore and aft on the cellular principle, and is fitted with steam steering gear, steam winches and windlass, while all other modern impovements have been introduced. Her engines are compound surfacing-condensing of the most improved description, and are 150 horse-power nominal. On leaving the ways she was named *Westfalia* by Mrs. W. T. C. Dutton, of Kilmalcolm. This steamer has been built under the superintendence of Mr. George M'Farlane.

Clan Macgregor—On July 29th a screw steamer, named the *Clan Macgregor*, built by Messrs. Ramage & Ferguson, Leith, to the order of Messrs. Cayzer, Irvine, & Co., Glasgow, for their Clan Line of Steamers, was launched. The ceremony of naming was performed by Mrs. Cruickshanks, of Liverpool. The vessel is 340 ft. long, with 40 ft. beam, a depth of 32 ft., and a registered tonnage of 3,000. Her carrying capacity amounts to 4,000. Her engines indicate 2,000-horse-power, and she is fitted up for 50 first-class passengers. She is registered highest class at Lloyd's, and also meets the Admiralty requirements for troop ships. She is the 19th vessel which the same company have had built within the last few years.

Alcinous.—On July 29th an iron sailing ship, named the *Alcinous*, was launched for Messrs. A. & J. H. Carmichael & Co., of Greenock, by Messes. Barclay, Curle, & Co., Whiteinch. The vessel is about 1,670 tons gross register, and is fitted with all the most modern appliances. She was named in the customary manner by Mrs. Brown, wife of the captain who is to command the ship.

Prinses Wilhelmina.—On August 1st there was launched from the ship-building yard of Messrs. John Elder & Co., Govan, an iron screw-steamer for the Stoomvaart Maatschappy, Nederland, named *Prinses Wilhelmina*. This vessel, with her sister-ship *Sumatra*, is to be launched in a few weeks, make five vessels which Messrs. John Elder & Co. have built for the same owners within a year. The principal dimensions of the vessel are:—Length between perpendiculars, 325 ft.; breadth, 37 ft.; depth (moulded), 27 ft.; about 2,600 gross tonnage. The engines are of the usual compound inverted cylinder type, with high pressure cylinder 38 in. diameter, low pressure 70 in., by 4 ft. stroke. The steam is supplied by two double-ended boilers at a pressure of 80 lb. The engines will work up to 2,000 indicated horse-power. The vessel is classed in the highest grades in Lloyd's and Veritas' books, and has all latest improvements for safe navigation and expeditious working of the cargo. Very commodious accommodation has been provided for 50 first-class and 25 second-class passengers, and the 'tween decks are also fitted up for carrying troops if required. The vessel was named by Mrs. H. B. Fisher, of Brighton.

Ardancorrach.—On August 2nd, Messrs. Blackwood Gordon launched at Port Glasgow, a steel screw steamer named the *Ardancorrach*, of the following dimensions:—Length, 244 feet; breadth of beam, 34 feet; depth of hold, 19 feet; of 2,450 tons gross. The engines, supplied by the builders, are compound surface-condensing, and of 120 horse-power. This new steamer has been fitted with a water ballast capacity of 340 tons in double bottom, and with the steam steering gear of Messrs. Bow and Maclachlan. She has been built for Messrs. Maclaren, Crum & Co., and is to be engaged in the Mediterranean and Black Sea trade.

Rowan.—On August 2nd, Messrs. H. M'Intyre & Co., Paisley, launched an iron screw steamer of about 1,100 tons gross register, for Messrs. P. H. Dixon & Co., Glasgow. Dimensions:—220 ft. long between perpendiculars; breadth, 32 ft. 6 in.; depth 16 ft. The steamer has been fitted with all the latest improvements, and will be supplied with machinery by Messrs. Muir and Houston, Glasgow. On leaving the ways she was named the *Rowan* by Mrs. George Dixon, Kelvinside.

Craighill.—On August 3rd, Messrs. Dobson & Charles launched from their shipbuilding yard at Grangemouth a steel screw steamer of 1,200 tons gross register. She has been built to the order of Messrs. Walker, Donald & Co., Glasgow, for their Spanish and Italian trades, and will be fitted up with all the most recent improvements for the weight-carrying class of steamer, including water ballast on the bracket and cellular system. Engines to indicate 700 horse-power will be supplied by Messrs. Hutson & Corbett, of Glasgow. The ceremony of naming her the *Craighill* was performed by Miss Agnes Houston, of Baranfron, Helensburg.

Firth of Olna.—On August 12th, Massrs. Dobie & Co. launched from the Govan shipbuilding yard another iron sailing ship, built to the order of Messrs. James Spencer & Co., Glasgow, for their Firth line. This vessel measures 1,250 tons gross, and is classed 100 A1 at Lloyd's. As the vessel left the ways she was named *Firth of Olna* by Miss Jessie Spencer, Craigton-house, Paisley-road. The *Firth of Olna* proceeds at once to load for Sydney, under the command of Captain Couper.

Lady Isabella.—On August 14th, Messrs. A. M'Millan & Son, Dockyard, Dumbarton, launched the *Lady Isabella*, 1,705 tons builders' measurement, which is the first of two double-bottomed iron sailing ships which are being built to the order of the North British Shipping Company, of Glasgow. The double bottom, which will contain 300 tons of water, is constructed on the longitudinal girder principle, is divided into three compartments, arranged to suit the trimming of the ship. Powerful pumps worked from the steam winch are fitted, capable of discharging the water at the rate of about 50 tons an hour; Emerson, Walker & Co.'s patent capstan windlass, and everything with a view to efficiency and economy of labour has been carefully studied and adopted in this ship. The naming ceremony was performed by Miss Grierson, of Glasgow.

Hypolite Worms.—On August 14th Messrs. Lobnitz & Co. launched from their shipyard at Slip Dock, Renfrew, a screw steamer for Messrs. Worms, Josse & Co., of Havre, of the following dimensions:—Length, 240 ft.; breadth, 31 ft. 6 in.; depth, 17 ft. 8 in.; horse power, 900 indicated. The vessel was named *Hypolite Worms* by Miss Hedwig Hoerder, of Aix-la-Chapelle, and the owners were represented by Monsieur Temoyne, their superintendent engineer. This is the fifth steamer built by this firm for Messrs. Worms, Josse & Co. for their Bordeaux, Havre, and Hamburg line, and is, like the others, fitted for passengers. She has water ballast in a tank hold and in the after peak, and is strengthened in the bow to resist the ice, which is always to be encountered in winter in the Elbe. The holds are specially arranged for the wine trade, and the vessel has the highest class both in Lloyd's and Veritas, and is to be commanded by Captain Severin Lemonier, the commodore captain of Messrs. Worms, Josse & Co.'s fleet.

Clan Forbes.—On August 15th there was launched by Messrs. Alexander Stephen & Sons from their yard at Linthouse, Govan, an iron screw-steamer of about 2,600 tons, for Messrs. Cayzer, Irvine & Co.'s Clan Line. She was named the *Clan Forbes*, by Miss Jenny Robin, of New Kilpatrick, and is the seventh steamer built for this line by the Messrs. Stephen, who have another similar vessel in course of construction. She is fitted with provision for water ballast in double bottom on the cellular principle throughout, and is built under special survey to class 100 A1, three-deck rule in Lloyd's, for the requirements of which her scantlings are considerably in excess. In order to permit of her being placed on the Government list of ships suitable for transport, she is furnished with the extra number of watertight compartments required by the Admiralty. The passenger accommodation is of a superior character, while special attention has been given to ventilation throughout. She is fitted with Emerson, Walker & Co.'s patent horizontal direct steam windlass. Her engines, built by Messrs. Stephen (and, as is their custom, fitted on board before launching), are of the most improved compound surface-condensing type, with cylinders 38 in. and 68 in. diameter by 45 in. stroke, with ample boilers suitable for a working pressure of 85 lb., while her appliances for working cargo and ship are of the most complete description.

Clan Sinclair.—On August 15th the steamer *Clan Sinclair*, a vessel of 3,000 tons register, built for Messrs. Cayzer, Irvine & Co., of the Clan Line, was launched by Messrs. Napier, Shanks, & Bell, Yoker, on the Clyde. She is a sister ship to the *Clan Graham*, built for the same firm, and is specially designed and fitted with every requisite for the Indian service. She is 330 ft. long; 40 ft. beam; and 29 ft. depth moulded; and is constructed under special survey, in excess of the requirements for Lloyd's highest class and the Board of Trade certificate. She has a double cellular bottom, formed by deep longitudinal girders, with transverse bracket floors, and extra web framing to sides, the whole giving very great structural strength and rigidity. The vessel has two decks of iron, the upper sheathed with wood planking, and web frames in lieu of orlop beams. The vessel has accommodation for 50 first-class passengers. The equipment connected with the navigation and working of the ship is of the most complete description, all improvements having been adopted to render the vessel thoroughly efficient under every contingency. The engines, constructed by Mr. David Rowan, Elliot-street, Glasgow, are of the most approved design, and have been made to meet the highest requirements.

William.—In August, Messrs. Scott & Co. launched from their building yard at Bowling an iron screw steamer of about 250 tons dead weight, built to the order of Messrs. J. Macfarlane, Oswald-street, Glasgow, and intended for the general coasting trade. The vessel will be fitted with compound surface-condensing engines, by Messrs. King & Co., Glasgow. On moving into the water, the ceremony of naming the vessel *William* was performed by Miss Dow.

Parahyba.—An iron screw steamer of 770 tons, built to the order of Messrs. Fry, Miers, & Co., London, and intended for the Brazilian coasting trade, has been launched by Mr. W. B. Thompson, Whiteinch, on the Clyde. She is 200 ft. long; 28 ft. broad, and 14 ft. deep, named the *Parahyba*. The vessel will be supplied with engines of 150 horse-power nominal, by the builder from his Tay foundry, with cylinders of 30 in. and 60 in. diameter, and 36 in. stroke.

Balgairn.—On August 15th, Messrs. Hall, Russell & Co., of Footdee, Aberdeen, launched from their yard a screw steamer named the *Balgairn*. She is constructed to carry 4,000 tons burthen. Her engines are expected to indicate 2,000 horses-power. and she is fitted for the American, Indian, and Australian trades. The christening ceremony was performed by the Countess of Aberdeen.

Talisman.—On August 16th Mr. William Watson, of the Ladyburn Boiler Works and Ship Dock, Port Glasgow-road, Greenock, launched from his yard a screw steamer, which was named the *Talisman*, and which has been built to the order of Messrs. William M'Lachlan & Co., Glasgow. She is 112 ft. long; 19 ft. broad; and 9 ft. deep. She is a vessel of 160 tons, and is to be engined by Messrs. Muir and Henston, of Glasgow. She is expected to attain a high rate of speed.

Seraglio.—On August 18th, Messrs. Robert Steele & Co., shipbuilders, Greenock, launched, from their shipbuilding yard, a steel screw steamer of the following dimensions:—Length of keel on fore-rake, 275 ft.; breadth (moulded), 35 ft.; depth, 23 ft. 6 in.; and about 1,700 tons register. She has been built to the order of Messrs. Raeburn and Véril, of Glasgow. On leaving the ways she was named *Seraglio*. She has a double bottom for water ballast in after-hold, and a trimming tank forward. Her accommodation comprises a topgallant forecastle for the crew, and a cabin aft for the use of the captain, officers, and passengers. She is intended for the general carrying trade, and will be supplied with the necessary steam windlass and steam winches for the rapid discharge and loading of cargo.

LAUNCH.—IRISH.

City of Cambridge.—On August 15th a steamship called the *City of Cambridge* was launched from the shipbuilding yard of Messrs. Workman, Clark & Co., Belfast. The steamer has been built for Messrs. George Smith & Sons, of Glasgow, and is intended to ply in the Calcutta trade of the firm. The dimensions are:—Length of keel and forerake, 400 ft.; breadth, 42ft.; depth of hold, 29 ft. 5 in.; gross tonnage, 3,900. The *City of Cambridge* has been built under special survey to class 100 A 1 at Lloyd's. She is three-decked, fitted with foremasts, square-rigged on the fore and main, watertight bulkheads, two iron decks, five steam winches —three single and two double—by Messrs. J. & J. Thomson. Accommodation is provided for 60 first-class passengers in a saloon on the upper deck. There is also a promenade deck on the top of the saloon. The engineers are Messrs. J. & J. Thomson, Glasgow. The engines have compound surface-condensing cylinders, 50 by 96 inches diameter, 6 ft. stroke; working pressure, 8 lb.; nominal horse power, 700. The new steamer will leave Belfast about the middle of September. Captain D. Anderson will be the commander. The ceremony of christening was performed by Mrs. Workman, mother of the principal partnerin the firm.

LAUNCHES.—FINLAND.

Krasnowodsk.—On Saturday, August 5th, Messrs. William Crichton & Co. launched from their shipbuilding yard at Abo, in Finland, an iron paddle steamer for the Russian Government, of the following dimensions: Length, 134 ft.; breadth, 28 ft., having a draught ofonly 3 ft. Before leaving the ways the customary Russian ceremony of sprinkling the vessel with water, &c., was performed, and she was christened the *Krasnowodsk*, being the name of a town in the neighbourhood of the Caspian Sea, whence she is destined, there tobe employed in the protection of the fisheries. The *Krasnowodsk* will be fitted with compound surface condensing engines of 240 indicated horse-power, supplied by Messrs. Wm. Crichton & Co., who engine all the vessels that they build themselves.

Olga.—Some days before this an iron tug steamer of the following dimensions was launched by the same firm: Length, 48 ft. 6 in.; breadth, 10 ft. 6 in.; draught, 5 ft. She is to be fitted with compound engines of 12 nominal horse-power, and is built to the order of Messrs. Thomas Clayhills & Son, of Reval.

Helmi II. is the name of an iron screw steam launch, launched on the 11th inst., of the following dimensions: Length, 50 ft.; breadth, 10 ft.; draught, 4 ft., also built by Messrs. Wm. Crichton and Co. She is to be fitted with an engine of eight nominal horse-power, (and is built for carrying passengers between this town and the neighbouring islands.

LAUNCH.—GERMAN.

On August 15th, a new spar-decked steamer was launched from the Flensburg shipyard to the order of Consul H. S. Talck, in Stavanger. As she left the ways she was gracefully christened *Rogaland* by Miss Grothusen. The following are her dimensions, viz.: length, 219 ft. 8 in.; breadth, 29 ft. 8 in.; draught, 22 ft.

TRIAL TRIPS.

Scrivia.—On July 26th, the *Scrivia* (s), which has recently been built by Raylton, Dixon & Co., proceeded on her trial trip from Middlesborough to the Tyne. She is an iron screw-steamer of the following dimensions:—Length over all 310 ft.; breadth, 40 ft.; depth of hold, 25 ft. 3 in.; and has a carrying capacity of 3,700 tons. She is built on Lloyd's three-decked rule, having all teak decks and fittings. She has a poop, long bridge and forecastle, steam steering gear, extra steam winches, water ballast in both holds and engine-room, and is intended principally for cargo carrying, but having accommodation for a few passengers fitted in the poop. Her engines, of 225-horse power nominal, are by Messrs. T. Richardson & Sons, of West Hartlepool, and on her trial trip gave a very satisfactory result in a speed of nearly 12 knots on the run from the Tees to the Tyne, where she will take in her first cargo for Genoa. This vessel has been built under the superintendence of Commendatore Mattei, for the firm of Messrs. Raggio & Co., of Genoa, who have at present seven large steamers building in this country for their South American trade.

Mona's Isle.—The official trial of this new paddlewheel steamer, built by Messrs. Caird & Co. for the Isle of Man Steampacket Company, took place on the 26th July. The speed maintained on a run of seven consecutive hours was at the rate of 18½ knots, or over 21 statute miles per hour. The result was highly satisfactory, the speed being one-quarter of a knot in excess of that contracted for.

Mary Beatrice.—A new steamer, named the *Mary Beatrice*, built by Messrs. Samuda Brothers, Poplar, for the South-Eastern Railway Company, and engined by Messrs. John Penn & Sons, of Greenwich, has had a journey down the river for the purpose of making her official trial trip. The dimensions of the vessel are as follows:—Length, 255 ft.; breadth, 29 ft.; depth, 15 ft. 6 in.; draught, 8 ft. 1 in.; and 1,063 tons burthen. The indicated horse-power of the engines is 2,800. She is distinctly an advance on the sister vessels the *Albert Victor* and *Louise Dagmar*, built by the same firm for the South-Eastern Railway Company two years ago, embodying several valuable improvements in her arrangements for the comfort of passengers, but notably in her additional length of five feet, whereby room and displacement have been obtained for the introduction of larger boiler and surface condenser, to which additions the excellent results obtained is mainly attributable. The usual four runs were made on the Maplin Sands, giving the extraordinary mean speed of 19.019 knots, or something over 22 miles per hour.

General Eliott.—The iron steamer *General Eliott*, which has just been completed by Messrs. Raylton, Dixon & Co., of Middlesborough, took her official trial trip to the Wear on Aug. 5th. She is built on the quarter-deck system, has water ballast in both holds, bridge amidships, top-gallant forecastle, iron decks, Bow & M'Lachlan's steam-steering gear, and all the latest improvements. Her dimensions are:—Length over all, 250 ft.; breadth, 34 ft.; depth of hold, 17 ft.; and has a carrying capacity of about 1,800 tons deadweight. The engines have been fitted by Messrs. Blair & Co. (Limited), of Stockton, and are of 130-h.p. nominal, having cylinders 31 in. by 58 in. diameter, and 36 in. stroke. She is a sister ship to the *Admiral Rooke*, which was finished a few weeks ago for the same Owners, Messrs. Smith, Imossi, & Co., of Gibraltar.

Milo.—The *Milo*, built to the order of Messrs. Leask, Clarke, & Co., of Hartlepool, by Messrs. Wm. Gray & Co., of West Hartlepool, sailed from West Hartlepool on Thursday morning last, laden with 1,600 tons of coals (cargo and bunkers), bound for Genoa, and had a very satisfactory trial trip under the superintendence of Captain Joseph Murrell, representative of the builders, and Captain Robert Clark, one of the managing owners. The *Milo* was found to steer admirably, and attained the speed of 10 knots per hour. Her dimensions are:—238 by 32 by 17, 110-h.p., A 1 at Lloyd's, and is under the command of Captain William George Harrison.

Grecian Monarch.—On August 17th, the *Grecian Monarch*, built by Earle's Shipbuilding and Engineering Company, Hull, for the Royal Exchange Shipping Company, the owners of the Monarch Line, was put on her official trial trip. She left the Hull Roads about 10 o'clock in the forenoon, having on board a large party of ladies and gentlemen, among them being representatives of both builders and owners. The compasses having been adjusted in the Grimsby Roads, the vessel put to sea, steering northward for the measured mile at Withernsea. Several runs were made, the mean of which showed 12½ knots. The vessel was in fair trim for a trial trip, drawing over 20 ft. water aft, having part of her outward cargo on board. The steamer is 400 ft. long, 43 ft. broad, and 33 ft. 3 in. deep. She has been built under special survey, and her class is 100 A 1 at Lloyd's and A 1* in the Liverpool Underwriters' Registry. She more than fulfils the requirements, having three iron decks sheathed with wood, the upper deck being of teak, as is also the saloon promenade. She is 4,364 tons gross, and 2,832 tons net register. Provision is made for 850 tons water ballast in the double bottom, which is constructed on the cellular principle. She has accommodation for 50 first-class passengers, 60 second-class, and 1,000 emigrants. On the homeward voyage from New York she will carry 700 head of cattle, and in addition she has a refrigerator for dead meat on one of the decks. The vessel has four iron pole masts, the fore and main being rigged with yards, and the mizen and jigger as fore and afters. She is built in seven watertight compartments, thus complying with the Admiralty requirements for transports. The *Grecian Monarch* has been specially designed for the grain, cattle, and passenger trade, and it may be remembered that a model of this steamer was exhibited at the recent exhibition in the Worshipful Company of Shipwrights' Hall, and was awarded the gold medal as the best design for Transatlantic steamers. The *Grecian Monarch* returned to Hull between 8 and 9 o'clock in the evening. She will leave for London in a few days to commence running on her station. The cargo she has taken in at Hull consists mainly of steel rails.

Invicta.—On August 5th a new Royal Mail steam-vessel was added to the fleet of the London, Chatham, and Dover Railway Company, under the name of the *Invicta*, which has been specially built for the conveyance of passengers across the Channel between Dover and Calais, and a most pleasurable and successful trial trip was made in her by a number of ladies and gentlemen at the invitation of Mr. James S. Forbes, the chairman of the Board of Directors. The weather was favourable to the enjoyment of the excursion. An easterly breeze tempered the heat of the sun, but haze somewhat restricted the view. The sea was smooth, not the least swell being perceptible throughout the passage either to or from the French coast, and the vessel glided through the water at the rate of about 20 miles an hour. No vibration was felt, and the pulsation of the engines was so feeble as to be unnoticed. The distance was traversed in one hour and 14 minutes, the boat having left the Admiralty Pier at Dover at 11.34, and reached Calais Harbour at 12.48. The wind may have been slightly against her, but, on the other hand, the tide was favourable. The *Invicta* has been built from designs by Mr. James Ash, the naval architect of the *France*, *Prince Imperial*, and other packets, and has been constructed by the Thames Iron Works Company, of Blackwall, while her engines and machinery are by Maudslay, Son, & Field. The length of the *Invicta* is 312 ft., breadth 33 ft., and, including paddle-boxes, 61 ft., depth 17 ft. 3 in. Her displacement at 8 ft. 4 in. draught is 1,251 tons, and her builder's measurement is 1,647 tons. She is built entirely of the best steel, has an upright stem and stern, with a rudder at each end, so that she can run out of harbour without turning round. She has six water-tight bulkhead compartments, and there are three steel keelsons on each side, with a middle line girder running throughout the vessel from stem to stern. With the exception of a break extending 50 feet from the sternpost, she has a flush deck right through to the stem, the forecastle being covered in for protection from the weather at that end of the ship, affording a delightful promenade. There is a range aft of 14 private cabins, with a commodious Royal saloon adjoining, all handsomely decorated and superbly fitted. A promenade is constructed running out to the ship's side, the whole length of the cabins to the sponson deckhouse, connected with the forecastle by a bridge, giving a range of 250 ft. from the stem to the afterpart or the deckhouses, She has two saloons, the second-class forward, and a grand saloon, 96 ft. long, aft, for first-class passengers. The ladies' saloon, about 16 ft. long, is protected on one side by a steel water-tight bulkhead. In the latter division is the refreshment bar, fitted with every requirement. The saloons all have access to them from the deckhouse, by two separate staircases. The ventilation throughout the cabins and saloons is perfect, and every part of the ship is lighted brillantly by the Swan electric system. The engines are on the diagonal oscillating principle, and are nominally of 600-horse power, but are expected to indicate 3,000. She has eight boilers, and steel has been used wherever possible. The engine-room is 70 ft. long, and the coal bunkers are athwart ships. Her fittings and decorations are of the most elegant and approved modern character. Amongst the company on board were Mr. J. S. Forbes, chairman, and several of the directors of the company; with Captain Godbold, Continental traffic manager; Mr. Morgan, secretary; and other officials; Lord Kilmorey, Earl Bathurst, General Newdigate, General Du Plat, Sir Sidney and Lady Waterlow, Lady Bruce, General D. Murray, General Hutchinson, Colonel Rice, M. Cousin, director of the Northern of France Railway; M. and Madame Noet, Madame Busin, Mr. C. Denison, and Mr. Oakley, of the Great Northern Railway; Mr. Cawkwell, and Mr. Finlay, general manager, London and North-Western Railway. Upon the company landing they were received by a deputation of the Municipal Corporation of Calais, and conducted to the salon of the Société de Philharmonic, where they partook of a *dejeuner*. Mr. Forbes presided, and "The Health of the Queen" and of "The Great Republic" having been duly honoured, the Chairman proposed "The Prosperity of the French and English Railway Undertakings," and pointed out the advantages resulting from the safe and rapid transit now afforded by the steamboat service across the Channel, to which the *Invicta* was another addition. M. Cousin, as representing the directorate of the Northern of France Railway Company, responded, referring to the spirited manner in which the London, Chatham, and Dover Railway Company carried out the task they had undertaken. The guests then returned to the *Invicta*, which made an equally satisfactory passage back to Dover. The trip was regarded as highly successful, the vessel meeting with universal approbation, whether as to her sea-going qualities or her internal economy, and Mr. Forbes was complimented on the splendid addition which had been made to the fleet of the Company.

Cephalonia (s).—The new steamer *Cephalonia*, built by Messrs. Laird Brothers, of Birkenhead, for the Cunard Steamship Company (Limited), made her trial trip on August 5th, with most satisfactory results. As this is the first vessel constructed on the Mersey for the Cunard service, more than ordinary interest attached to the trip, The *Cephalonia* was floated from the Birkenhead Ironworks on May 20th last, and was taken into the Great Float, where she was fitted up. Before giving a description of the trial trip, it may be stated that the new vessel is the largest steamer built on the Mersey for the mercantile service. It may, however, be noted that her extreme length on the upper deck is 440 ft; length between perpendiculars, 430 ft.; beam, 46 ft.; depth in hold, 34 ft. 6 in.; tonnage, B.M. 4,530 tons; gross register about 5,500 tons. She is constructed of iron, and is fitted to carry about

150 first-class passengers, and 1,500 steerage, besides her crew. The ship is lighted by Swan's electric light, both in the engine-room and in the cabins, and pneumatic bells fitted to each room. The rig is that of a barque, with a good spread of canvas. The masts are of steel, the fore and main being in one piece up to the top-masthead. The mizen is in one piece the whole length; the lower yards are also of steel. In addition to accommodation for the large number of passengers, the deadweight and cargo capacity, from 4,500 to 5,000 tons, will probably be as great as any vessel afloat. The machinery is on the compound system. The engines, which are 3,500 horse-power, have two cylinders, the high pressure one being 52 in. diameter, and the low pressure 93 in. diometer, with a stroke of piston of 5 ft. 6 in. The crank shaft is one of Vickers' built-up steel shafts. The propeller is four-bladed, the boss as well as the blades being of Vickers's cast steel, and the blades are secured to the boss by steel bolts and nuts. The boilers are six in number, arranged in two sets of three each, and having one funnel. They are cylindrical, 15 ft. 10½ in. diameter, and 10 ft. long, and each boiler has three furnaces, which are fixed athwartships, the stokehole being in the midddle of the ship, and having three boilers on each side. They will be worked at a pressure of 90 lb. per sq. in., having been proved to 180 lb. by water pressure. At the trial trip the *Cephalonia* was in command of Captain Hoseason, late of the steamship *Samaria*, and there were about 100 ladies and gentlemen on board. The *Cephalonia* proceded slowly down the Mersey, and passed the Rock Light shortly after 11 o'clock. The whole day was occupied by the engineers and builders in testing the machinery and the sea-going qualities of the vessel. In the early part of the day, the engines were kept running from 45 to 48 revolutions per minute, with 50 lb. of steam, in order to bring all parts of the machinary to work. Owing to a slight derangement of the supplementary engines for working the circulating pumps, the engines had to be slowed and stopped for a short time, and, the parts having been examined and re-adjusted, the engines were again started, but in consequence of one of the piston rods becoming warm, it was decided to run at a slow speed for a further short time. The vessel was then taken back to the North-West Lightship, and from that point was run to the Bar Ship, the engines making about 52 revolutions per minute, and the speed by log at the rate of 14 knots an hour. The ship was next turned to the westward, and a further run made for half an hour, the engines going 54 revolutions per minute with 75 lb. of steam, and a speed of nearly 15 knots by log. As the steam increased, the vessel continued on the run, and showed that the boilers were fully capable of maintaing the maximum work expected. The speed contracted for was 13½ knots an hour, but the result of Saturday's working shows that the vessel will go at a considerably higher rate.

Twin Screw Pinnace.—After lunching on board the *Enchantress*, the Lords of the Admiralty, on August 24th, devoted some time to witnessing the remarkable performances of an experimental twin-screw pinnace, built and engined by Mr. J. Samuel White, of East Cowes, and which was steamed at the express request of Admiral Key. The weather at the time was wet and windy or their lordships would have gone on board. In the circumstances they contented themselves with observing its evolutions from the deck of the yacht. The form of this boat is somewhat peculiar, and will probably effect material changes in twin-screw men-of-war. Some time ago Mr. White built a 60-foot "turnabout" cutter for the *Inflexible*, which proved so handy and useful, that he received an order to build a similar single screw craft for the *Vernon* torpedo ship for purposes of instruction. The novelty connected with the boats lies in the circumstances that they are denuded of their dead wood, and fitted with an inner and a main rudder, which are simultaneously moved by the same wheel. By these means they are enabled to turn in their own length both ahead and astern, and to steam backwards and forwards with almost the same rapidity. It was proposed to apply the principle to the *Caroline* corvette, now building at Sheerness, but it was objected on the part of the Admiralty that in ships of this class steam was auxiliary to sails, and that it was undesirable to make any change in the form of their sterns, at the same time it was suggested that as all armour clads were now properly twin screws, the "turnabout" principle should be tested upon a pinnace, similarly propelled, with the special object of demonstrating its applicability to men-of-war. The boat has been expressly built for this purpose, and not as a ship's pinnace. It is 48 ft. long, and is fitted with three rudders—namely, the main rudder in the usual place, and two auxiliary rudders directly over the screw shafts and before the screws. The engines are of the usual compound type, The pinnace was tried by Mr. White in two sets of evolutions. It was circled ahead and astern with both engines moving at full speed, and with one engine only going, the other being supposed to have been disabled. There was, practically, little difference in its capacity. No *data* were taken on the occasion, so that the results obtained by the Dockyard officers, a few days previously, may prove instructing and interesting to engineers and others. Tried on the measured half-mile the speed ahead was found to be 12 knots, and the speed astern nine-and-a-half knots, and it could be steered quite as easily in one direction as another, a property which no ordinary boat possesses. The horse-power was 140, the revolutions were 330, and the steam pressure was 120 pounds. It was subsequently tested as to its turning powers both with the dead wood cut entirely away (its normal condition), and with the dead wood partially blocked up, as the large amount of overhang aft might be regarded in some cases as an objection to the full development of the principle. The result showed that, while the craft was not quite so handy and sensitive with the dead wood partly blocked, she was still far handier than any ordinary twin screw boat. It was also demonstrated that it is possible to build a ship in which the keel could be extended sufficiently aft for any requirements in docking, and still retain a very large portion of the handiness due to the turnabout system. Without a deadwood the boat could turn a complete circle in two lengths, and with the deadwood in three lengths with both engines going ahead, and with the engines going astern the circles were turned in five-and-a-half lengths and seven lengths respectively. Further experiments are to be made.

TRIAL TRIP.—GERMAN.

Glucksburg (s.s.).—On August 14th the new s.s. *Glucksburg*, built and engined by the Flensburg Iron Shipbuilding Company, to the order of the Steam Navigation Company Globus, took her trial trip in the Flensburg Bay. She is a spar-decked vessel, and is intended for the China trade. The following are her dimensions, viz.: Length, 244 ft.; breadth, 33 ft.; draught, 23 ft. 6 in., with a nominal horse-power of 160. The accommodation for captain, officers, and a few passengers is arranged on spar deck in iron houses. The space between spar and main deck right fore and aft is so arranged that it can be used for passengers or for cargo. There were over 100 gentlemen on board to witness the trial. The vessel obtained a speed of 11 knots an hour, which gave great satisfaction to all on board.

Small light draught twin screw steamers, for the service of the Argentine Republic.—In November of last year the Consul-General of France for the above Republic entered into a contract with Messrs. Edwards & Symes, Shipbuilders, London, for the construction of four iron light draught twin screw steamers. The trial trip of the first took place on June 16th. The remaining three are much smaller, being only 60 ft. long, 12 ft. broad, and 6 ft. deep, with raised quarter deck and forecastle, and fitted with bilge keels. One of these, the *Mendoza*, proceeded down the river on the 29th July, to the measured knot at Long Reach, for her official trial trip, and on the result the builders deserve hearty congratulations, the mean draught of water being only 3 ft., and on this very little draught, the mean speed of 9·83 knots on four consecutive runs was attained, realising more than the contract speed, and the expectation of the builders. The propelling machinery consists of two sets of compound surface condensing engines, high-pressure cylinder, 8 in. diameter, and low-pressure, 14 in. diameter, each set driving a screw 3 ft. 5in. diameter. The engines are supplied with steam from an ordinary marine return tube boiler, which maintained a pressure of 85lb. throughout the trial, driving the engines 225 revolutions per minute, the vacuum on both condensers being 25, the whole of the machinery working most satisfactorily during the whole time the vessel was under steam, and is now well on her passage steaming out to South America.

A MEETING of the Clyde Shipbuilders' and Engineers' Association was held on the 30th August, in Glasgow. The request of the ship-joiners for an advance of wages was again considered, but after a long discussion it was unanimously agreed not to concede it; the unanimous opinion of the employers was that the time had arrived for putting a stop to the advances of wages that have been going on in the shipbuilding trade during the past two years.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 25th July to 28th August.

3427 J. Pinchbeck. Rotary engines.
3432 G. Hoper (communicated to E. G. Brewer). Screw propellers.
3446 F. H. Ball (communicated to H. J. Haddon). Governors.
3451 A. I. Rath. Swimming belt.
3452 R. Duncan. Screw propellers.
3460 D. Purves. Screw steamer crank shafts.
3499 J. McAuley. Grain elevators.
3503 R. C. Holman and W. C. Draper. Hammocks.
3512 F. W. Brewster. Life-preserving garments.
3556 C. Grayson. Boat lowering appliances.
3574 J. Judson (communicated to W. R. Lake). Governors.
3612 J. Walker. Haulage clips.
3624 E. Lawson and E. W. de Rusett. Sleeping berths.
3632 D. Forbes and J. Hayes. Marine and other engines.
3642 T. J. Edwards. Boat sculling apparatus.
3649 H. Hardy. Screw propellers.
3651 J. Boissié (communicated to W. E. Gedge). Tartarifuge for steam boilers.
3662 P. Revollon (communicated to G. Sonnenthal). Steam boiler tube expander.
3664 T. Marlborough and J. Cunningham. Tarpaulin fastening.
3677 J. J. de Lancey (communicated to A. M. Clark). Balanced slide valves.
3707 C. J. Galloway and J. H. Beckwith. Compound steam engines.
3709 W. G. Wreuch. Propellers.
3733 G. C. Parini. Propellers.
3734 L. E. Mansfield. Grain raising, &c.
3739 J. G. Jones. Rotary engines.
3780 A. Kissam. Rotary engines.
3799 J. H. Smiles. Steam steering gear.
3827 C. W. Harding. Automatic compression and storage of air by the action of sea waves, and generation of electricity therefrom.
3832 L. Dove. Self-acting steam traps.
3848 J. Beck. Steam engines.
3855 G. Porter. Pneumatic signalling apparatus.
3866 J. Edge. Valve motions for steam engines.
3870 J. Imray (communicated by C. H. F. Russmann). Steam boilers and generators.
3871 A. B. Brown. Starting engines.
3888 W. R. Lake (communicated by T. Holland). Lubricating apparatus.
3890 R. R. Gubbins. Pistons.
3902 W. R. Lake (communicated by H. J. Lidgerwood). Hoisting or lifting apparatus.
3914 P. Armington. Steam engines.
3915 J. Kennedy. Extinguishing fires.
3925 A. H. Williams. Improved construction of pontoons for military purposes, and for raising sunken vessels, and for use in saving life and property at sea.
3942 W. B. Tibbits. Improved pump.
3957 E. T. Hughes (communicated by automatic boiler and engine company of New Haven, Connecticut). Automatic pump or boiler feeder.
3969 J. Chaffin. Skylights.
3981 Shanks and Lyon. Steam engines.
3988 J. E. Hunter. Raising sunken vessels.
3992 J. M. Xavier Terlinden. Rotatory engines.
4001 A. W. L. Reddie (communicated by Nicolas Tverskoy and P. Weiner). Rotary engines.
4008 W. R. Lake (communicated by M. Fernberg). Indicating the position of sunken ships, &c.
4010 R. H. Brandon (communicated by W. E. Woodbridge) Construction of cannon.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

July 29th, 1882.

Algie, James ...	1 C	London.
Barker, John ..	1 C	Lvrpool.
Cairns, John S.	1 C	N Shlds.
Cooper, John ...	2 C	Glasgow.
Cowie, William	2 C	N Shlds.
Dalgliesh, Adam	1 C	Glasgow.
Don, Alexr. G.	1 C	do.
Duncan, Thomas	2 C	do.
Edmond, Wm.	1 C	Lvrpool.
Fisher, Hugh ...	2 C	Glasgow.
Galbraith, Archibald	2 C	do.
Galloway, R. Mc A...	2 C	N Shlds.
Gowans, Thomas	2 C	London.
Hay, James ...	1 C	N Shlds.
Hendry, George	1 C	Lvrpool.
Hildreth, John	1 C	Glasgow.
Hughes, Wm. O.	1 C	Lvrpool.
Jacks, Jas. W.	1 C	N Shlds.
Lightfoot, Johnathan	2 C	Lvrpool.
Mackie, Alexr.	1 C	do.
Mackay, Joseph	2 C	Glasgow.
Malcolm, D. C.	1 C	do.
McSparran, Dan.	2 C	Glasgow.
Moon, James ...	2 C	Lvrpool.
Noble, James ...	1 C	Glasgow.
Ransin, Finlay	2 C	do.
Rodger, Geo. W.	2 C	do.
Scott, Geo. D.	1 C	N Shlds.
Shachan, Andrew	1 C	London.
Sinclair, Jas. W.	2 C	N Shlds.
Steven, David...	2 C	Glasgow.
Thomson, Alex.	2 C	do.
Waldridge, Alf.	2 C	London.
Williams, Wm. R....	2 C	Lvrpool.

August 5th, 1882.

Atkinson, John	2 C	Sundrlnd
Borland, Andrew	2 C	London.
Carmichael, David	2 C	do.
Cavers, Charles	1 C	Lvrpool.
Davies, David E.	1 C	S Shlds.
Davy, Thos. J....	2 C	Hull.
Fussholler, E. E. C.	1 C	S Shlds.
Gouch, James ...	2 C	Sundrlnd
Heppenstall, Geo	2 C	Sthmptn.
Isles, David	2 C	London.
Jobbing, Preston	2 C	N Shlds.
Kidd, William...	1 C	do.
Kinnear, George	2 C	Leith.
Kirkness, James	2 C	do.
Laycock, Emmanuel ...	2 C	Hull.
Low, Geo. B. ...	2 C	London.
Marquand, A. J.	1 C	Sundrlnd
McLean, Lachlan	2 C	Grnock.
McLennan, Daniel	1 C	N Shlds.
McLoughlin, J.F.	2 C	Lvrpool.
Mee, F. Henry...	2 C	London.
Melville, John ...	2 C	Lvrpool.
Miller, Alex......	2 C	Grnock.
Pattison, James	1 C	N Shlds.
Person, Victor M.	2 C	do.
Povall, John J....	2 C	Lvrpool.
Pride, James......	2 C	do.
Prydie, John......	1 C	do.
Robertson, C. E.	2 C	Leith.
Shanks, James...	2 C	N Shlds.
Smith, James ...	2 C	Leith.
Southworth, R...	2 C	London.
Steward, Saml...	2 C	N Shlds.
Swainston, W.H.	2 C	Sundrlnd
Watters, John H.	2 C	do.
Weaks, James...	2 C	N Shlds.
Williamson, Rt.	2 C	Leith.
Williamson, A...	2 C	Lvrpool.
Wyles, Alex......	2 C	Glasgow.

August 12th, 1882.

Bails, John R.	1 C	N Shlds.
Ball, R. H. ...	2 C	Plmouth.
Bowie, Hugh ...	2 C	Glasgow.
Campbell, James	2 C	do.
Cranston, Archibald	2 C	do.
Duguid, William	2 C	N Shlds.
Fletcher, Wm. J.	2 C	Glasgow.
Garrick, James	2 C	Lvrpool.
Hanson, Edwin R....	2 C	Glasgow.
Holden, Joseph	2 C	Lvrpool.
Hoy, William ...	1 C	N Shlds.
Hunter, Archibald	1 C	do.
Jackson, J. G.	1 C	Lvrpool.
Jackson, Wm.	1 C	do.
Johnson, John	1 C	Glasgow.
Kirkaldy, John	1 C	London.
Marshall, John	2 C	Glasgow.
McIntosh, Jas. C.	2 C	do.
Melville, J. W.	2 C	N Shlds.
Mitchell, James	1 C	do.
M'Kinlay, Dun.	1 C	Glasgow.
Paterson, Thos.	2 C	do.
Potts, James ...	2 C	N Shlds.
Ramsay, David	1 C	Lvrpool.
Shaddick, J. W.	2 C	London.
Sheppard, H. A.	2 C	Lvrpool.
Snodgrass, A.	1 C	Glasgow.
Speers, James	1 C	N Shlds.
Stewart, W. G.	1 C	London.
Thomas, Hugh	1 C	Lvrpool.

August 19th, 1882.

Bendall, Wm. J.	1 C	Cardiff.
Davidson, Alex.	2 C	do.
Donaldson, Jas. A....		Dundee.
Dorman, Joseph	2 C	Cardiff.
Gray, Lawrence	2 C	N Shlds.
Haley, Patrick	2 C	Cardiff.
Hunton, Jas. S.	2 C	Hull.
Jones, Edwin ...	2 C	Cardiff.
Lister, Abram B.	2 C	London.
Mac Ewen, T.C.	2 C	N Shlds.
Moore, Andrew	2 C	do.
Morgan, Jno. E.	2 C	Cardiff.
Palmer, David	2 C	N Shlds.
Pugh, Hugh ...	2 C	Cardiff.
Puttock, Arthur	1 C	London.
Robertson, Robt.	1 C	Lvrpool.
Robinson, W.	2 C	N Shlds.
Todd, James ...	2 C	Cardiff.
Williams, Robt. F....	2 C	do.
Willis, Arthur...	2 C	do.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

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The Marine Engineer.

LONDON, OCTOBER 1, 1882.

EDITORIAL NOTES.

We owe our share of thanks to the authorities of the Portsmouth dockyard for the most interesting and entertaining inspection that they have afforded on the 4th of the past month to the Society of Engineers. Officers were kindly detailed to conduct the visitors, who were upwards of 100 in number, over the torpedo factories, the docks, the *Excellent*, the Gatling butts, and the available ironclads. On board the *Excellent* the broadside firing by electricity and other gun practice and drill was inspected with great interest by the visitors, and thence they were taken by steam launch to see the Gatling and Nordenfelt guns fired at their test butts. The precision of the guns was admirable, all the shots striking the target and most of them very close to the bull's-eyes. The penetration of the bullets was very good, and the explosions of the shells on the plates would have proved very destructive. The great strength and hardness of the chilled steel bullets of the Nordenfelt gun were remarkable, many specimens being picked up intact after having pierced an inch or more into an iron plate and then rebounded twenty or thirty feet. The visit to the turrets and big 80 ton guns of the *Dreadnought* afforded a most wonderful specimen of the perfection of mechanism as applied to the complicated movements of running out and drawing back the 80-ton guns, depressing, loading, ramming, and revolving the turrets with the greatest smoothness and ease. The joyful news of the taking of Tel-el-kebir was a fitting conclusion to so pleasant a day.

The Americans are coming out as authorities on marine steam boilers. Mr. Shock, of the U.S. Navy, has given to the world a most exhaustive treatise upon not only boilers but the science of economical evaporation, and reliable construction. The marine boiler is undoubtedly a delicate structure, and subject to rapid deterioration and destruction if not closely watched. The constant use of the blast, the deposit of saline calcareous and other incrustations, the intrusion of fatty matter, and both internal and external pitting, all seem to combine against the marine boiler to make it short lived. Mr. Shock lays much stress upon the antagonistic conditions that surround the question of the design of marine boilers, and hence the consequence that the ultimate design is usually a compromise between two disadvantages The space available is usually so cramped that much has to be sacrificed to want of room. The imperfect and variable draught also of marine boilers serves to greatly impede combustion, and so to interfere with the evaporation that might be expected from any given area of grate and heating surface. There is little doubt that marine boilers, and their proper accommodation will obtain more and more consideration in our Ironclad Navy. This is already to be seen in the special boiler arrangements of the *Iris* and *Mercury* where they are placed in large stoke holds fore and aft of the engine room, instead of being crowded up in a single tiny stokehold. Steel locomotive boilers are also receiving attention, and have been adapted to the *Polyphemus*, to give very high working pressures with economy of space. Mr. Sennett gives as evaporative data, that low pressure boilers at full power burn about 30lb. of coal per hour, and get 10 indicated horse power out of each square foot of grate surface. Mr. Shock considers that from 20lbs. to 30lbs. of steam is required per indicated horse-power per hour, and that the average marine boiler does not obtain more than 4.5 to 7.5 indicated horse-power per square foot of grate. With forced blast these results of evaporative power of grate may be very largely increased, and there is little doubt that a system of forced draught will soon be very generally adopted, as it gives a power of rapidly increasing the combination when required, as, for instance, when in action.

COMPOUND steel-faced armour plates are acquiring the highest possible character for endurance and resistance to impact. Certain plates have been subjected to the most severe test, such as no plain iron or steel plate could have withstood and have come out with flying colours. The plate in question was 11 inches thick, with a facing of 3¾ inches of steel. It was fired at first by a 9-inch 12-ton gun at short range of 30 feet, but the cracks produced never extended beyond the steel facing, and the iron backing remained intact. The maximum penetration was 4.7 inches, whilst the bulges at the back never exceeded ⅜ of an inch. The 9-inch gun was thus found quite inadequate to effect any sensible destruction of the plate, and a 10-inch 18-ton gun was brought into play, it being thought that one shot from this gun at 30-feet would complete the destruction of the plate. The projectile from this gun had a slightly less velocity than that of the 9-inch gun, but from its greater weight had at least 30 per cent more striking energy. The penetration was, however, only 4.4 inches as compared with the 4.7 inches of the lighter gun, whic points out a fact too little recognized that penetratio is the result of velocity rather than of weight. Th plate thus successfully withstood the heavy batteri of 10-inch shots without penetration or destructi cracking, and showing only inside maximum bulges of 1 1-16 inches. This is a remarkable result,

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No more collisions! Here is news for our underwriters and ship-owners. It would be a startling improvement to their profits if all the many risks and losses due to collisions were eliminated for the future. It is again the Yankees who have come forward to relieve us of this dreadful species of disaster. A Boston genius has hit upon a plan by which he maintains that a steamer at full speed can be brought to a standstill in its own length or less, and that, too, without reversal of the engines. Two fins are hinged to the stern-post of the vessel, one on each side, and so long as all goes well these remain tightly closed in a line with the keel. So soon, however, as a collision is imminent, or an unexpected danger ahead is visible, the fins are shot out by deck machinery, at right angles to the hull, and the vessel is brought to a standstill within a few yards. The inventor does not say what would be the effect upon the stern-post. An automatic action can be given to the fins for thick weather. A long sprit is rigged out at the bows, and the moment it meets with any obstacle it releases the fins, and the ship, if not going more than half speed, is said to stop instantaneously. That a heavy vessel may be brought to rest very rapidly, and yet without shock, by a good hold on the water, is undoubted, but we think the inventor has not yet calculated the enormous gross pressure thus thrown upon the fins he suggests, and the dangerous strain thus thrown upon the stern-post. The weight also of such fins and attachments would be very great, and they might tend to retard the velocity of the vessel whilst closed against her side. This, however, may be only the first crude suggestion, and we see no reason why vessels should not eventually be provided with brakes, as well as railway trains.

FROM a statement made by Sir William G. Armstrong during the course of his speech at the inauguration of the North-East Coast Exhibition, Tynemouth, it appears that his firm is about to be amalgamated with that of the well-known shipbuilders Messrs. Charles Mitchell & Co., and that by this act the two greatest yards on the Tyne come under one government, the style and title of which is not yet officially stated,

HYDRAULIC MACHINE RIVETTED MARINE BOILER.

TWEDDELL'S SYSTEM.

A LARGE proportion of the rivetting in marine boilers (as now constructed) has been for the last 15 or 16 years, done by Mr. Tweddell's Stationary Hydraulic Rivetting Machines.

Unfortunately, there still remains a great deal of rivetting to be done by hand, and, in closing in the front plate, the rivetting is as heavy as that of the shells.

We have alluded elsewhere to the very interesting Exhibition of hydraulic rivetting machinery for ships on Mr. Tweddell's system, at Tynemouth, as manufactured by Messrs. Fielding & Platt, of Gloucester.

Being, however, in the section devoted to "Marine Engineering," attention has also been very properly called to the equally important question of improvements in marine boiler construction. Some excellent flanged work is shown, not only at this but at other stands in the Exhibition, notably, those of Messrs. Eltringham and the Wallsend Slipway and Engineering Company, Limited, all flanged on this system. Mr. Tweddell also shows a design of a marine boiler, so plated and put together as to enable practically every rivet to be closed by hydraulic pressure.

It must be understood that in designing this boiler, Mr. Tweddell has treated the question of machine rivetting as of the first importance, and he is well aware that there are one or two points in the design which are open to discussion.

Referring to our illustration, which is of course only in the form of a diagram, the numbers (1), (2), (3), (4,) shew rows of rivets, which are now all done by fixed machines, before the furnaces, &c., are put in their places.

Supposing there to be enough lifting power available, the seam (5) could also be closed by a fixed machine, but as this would seldom be the case, it is proposed to close these rivets *after* the furnaces are in place, by a portable rivetter as shown at A, the boiler remaining stationary. The portable rivetter is suspended to a crane, and the machine itself being free to revolve on its trunnion B, adapts itself to the different positions of the rivets while travelling round the boiler front, the same portable rivetter removed to position C, closes the rivets in furnace front (6), and should an angle iron joint (5 A) be used instead of the form (5), then the same portable being suspended somewhat differently as shown at D can close all the rivets (in this arrangement the machine revolves in the fork H).

Previously to placing the furnaces and combustion chambers within the boiler, a portable rivetter, similarly suspended to this last and placed as shown at E, closes the furnace strengthening rings (7), and if the mode of plating shown in the combustion chambers be adopted, then a portable rivetter as shown at F will do all the seams (8) (8), the seam (9) being rivetted on as now by a stationary machine.

It is clear that by this means practically *every* rivet can be put in at a *known pressure* by machinery, and it now only remains to mention some of the objections raised to the design.

Objection is frequently made to the form of joint shown at (6) (6). Nevertheless we notice that several boiler makers now use it, especially with furnaces in one length of plate.

The form of joint shown at (5) is probably the most experimental in Mr. Tweddell's design, and if done by hand would be impracticable, but if done by machine and all the holes drilled, it should be a good joint; if, however, this is thought too venturesome, there is the angle iron joint, No. 4. Considerable prejudice exists against this form of joint also, but it is one used in a great number of land boilers, and if closed by machine cannot but be tight. Then again, in the combustion chambers, the joint (8) has been, we believe, in successful use for some years by at least one Clyde engineering firm. In conclusion, we are quite sure that to no one will criticism be more welcome than to Mr. Tweddell.

The boiler has been designed as before stated, from a "rivetting" point of view, and in considering the merits or otherwise of the design, we must take into consideration the balance of advantages, *i.e.*, does the *machine* rivetting not compensate for a somewhat less theoretically perfect form of joint.

COMPOUND INVERTED MARINE ENGINES AT THE NORTH-EAST COAST EXHIBITION.

THE double-page engravings we give this month illustrate a pair of inverted direct acting surface condensing screw engines of 500 indicated horse-power, constructed by the Wallsend slipway and engineering Co., Limited, of Newcastle-on Tyne, and forming their principal exhibit at the North East Coast Exhibition. These engines are very favourable examples of the ordinary modern type of compound marine engines, the design being simple and compact, while the wrought iron columns in front, which are also adopted by the company in their smaller classes of engines, enable the working parts to be readily inspected, and render them very accessible in case of repairs or overhaul.

The ratio of the capacities of high and low pressure cylinders is 1 to 4, the diameters of pistons being respectively 26 inches and 52 inches, while the stroke is 33 inches. This ratio is greater than is generally found in engines of this class for the merchant service, but it is of course favourable for fully utilizing the expansion of high pressure steam, 80 pounds per square inch being adopted in the present instance.

The engines are built to the order of Messrs. Dixon, Robson & Co., of Newcastle-on-Tyne, for a vessel now building at Sunderland by Messrs. John Priestman & Co., and though no special peculiarities or expensive refinements are attempted, the result is a plain substantial piece of workmanship of first-rate design and finish in all parts, such as we understand is supplied by the Wallsend Company to their customers in the ordinary way of business.

The construction of these engines and their details being so fully shown in the engravings, besides being of a well-known type, we refrain from giving any special description. Our illustrations are prepared from drawings courteously furnished by Mr. William Boyd, the managing director of the company.

RAPID ATLANTIC TRIP.—The Guion steamer *Alaska* has just completed a most extraordinary voyage from York. On Tuesday, September 12th, she started on her voyage at seven o'clock in the evening, New York time, or half-past eleven Greenwich. On Tuesday afternoon she passed Browhead signal station—Ireland—at ten minutes past two, and to cross the bar of the Mersey about two o'clock on Wednesday morning at flood tide. It will thus be seen that the problem of a seven days' trip from New York to Liverpool has almost been solved, for the actual time occupied on the trip of this hitherto unrivalled steamer on her voyage from New York to the Irish coast has been six days fourteen hours and forty-eight minutes and to Liverpool, little over seven days.

DIMENSIONS AND PERFORMANCE OF THE HULL AND MACHINERY OF THE UNITED STATES STEAMER "DISPATCH," WITH ANALYSES OF THE POWER DEVELOPED.*

By Chief Engineer ISHERWOOD, U.S. Navy.

Continued from page 144.

THRUST OF THE SCREW DURING THE ABOVE AVERAGE PERFORMANCE.

The thrust of the screw, as it would have been measured by a dynamometer, during the above average performance, calculated from the data just given, as precedingly described, is as follows:

The horses-power expended in the propulsion of the vessel, according to the above "distribution of the power," being 206·5997, is equal to $(206{\cdot}5997 \times 33000 =)$ 6817790·1 foot-pounds of work per minute; and the speed of the vessel being 9·9195 geographical miles per hour, is equal to $\left(\frac{10{\cdot}75 \times 6086}{60} =\right)$ 1006·16795 feet per minute; hence the resistance of the vessel at that speed, or its equivalent the thrust of the screw, is $\left(\frac{8882827{\cdot}8}{1090{\cdot}4083} =\right)$ 6775·996 pounds.

DETERMINATION OF THE POWER EXPENDED DURING THE ABOVE AVERAGE PERFORMANCE, IN OVERCOMING THE RESISTANCE OF THE WATER TO THE IMMERSED EXTERNAL OR WETTED SURFACE OF THE HULL.

Taking the resistance of water to one square foot of rolled copper surface, moving in it with the velocity of 10 feet per second, to be 0·45 pound; and at other velocities to be this quantity modified in the ratio of their square to the square of 10; and deducing from the speed of the vessel the mean speed of its immersed surface due to the inclination of its horizontal water lines to its longitudinal central plane, there results for that speed 16·58 feet per second, and, consequently, a surface resistance of $(10^2 : 0{\cdot}45 :: 16{\cdot}58^2 =)$ 1·237 pounds per square foot moving with that velocity.

As the immersed external or wetted surface of the vessel, during the above average performance, was 5516 square feet, the power expended in overcoming its resistance was $\left(\frac{5576 \times 1{\cdot}458 \times 18 \times 60}{33000} =\right)$ 205·6912 horses. Now, according to the "distribution of the power" developed by the engines during the average performance, the power expended in the propulsion of the hull was 206·5997 horses; consequently, the entire resistance of the vessel was sensibly that of the water to its immersed external surface. This result, from data wholly independent of that given by the Board of Naval Engineers for the previous experiment, and obtained by different persons and at different times, shows both the accuracy of the observations and of the constants, as well as the correctness of the method and the deduction.

THE ECONOMIC RESULT.

The cost of the power developed by the engines in fuel appears very great, reaching to nearly four pounds of anthracite consumed per hour per indicated horse-power, the refuse from the coal being a little over one-fifth of the latter; and the cause will be found, as might be expected, in the enormous cylinder refrigeration due to the work of expansion by steam of high initial pressure largely expanding, the point of cutting off being a little beyond one-ninth of the stroke of the pistons from the commencement. Under these circumstances, when saturated steam is used with simple engines having cylinders of very moderate dimensions, without steam jackets, as in the *Dispatch*, the cylinder condensation is excessive and entirely defeats the economy which might be obtained from the same measure of expansion employed with superheated steam in steam-jacketed cylinders of large dimensions. In fact, saturated steam cut off at one-ninth of the stroke of the piston, in cylinders like those of the *Dispatch*, produces no greater economy than if it was used with very much less expansion.

Assuming the economic vaporization of the boilers to have been about eight pounds of water, from the temperature of the feed, per pound of anthracite consumed, which was probably near the truth, the results from the indicator diagrams show that during about the first ninth of the stroke of the pistons, about 57½ per centum of all the steam entering the cylinders was condensed by their surfaces; including, of course, the surfaces in the steam passages up to the valves. Of course, during this one-ninth of the stroke of the pistons no power whatever was obtained from 57½ per centum of al the steam generated in the boilers. From the point of cutting o the steam to the end of the stroke of the pistons, there went on continuous re-evaporation of this water of condensation under th continuously decreasing pressure due to the continuous develo ment of space by the moving pistons, but the steam produced this re-evaporation pressed the pistons for only the remainder their stroke from the point where the re-evaporation took pla The re-evaporated steam did not, probably, act through more th 45 per centum of the stroke of the pistons, and during that with very small average measure of expansion, the expansion becoming less and less as the re-evaporation took place later and later. The intended measure of expansion due to the cutting off at one-ninth of the stroke of the pistons from the commencement thus applies to only $(100{\cdot}0 - 57{\cdot}5 =)$ 42½ per centum of the steam generated in the boilers. When the pistons reached the end of their stroke the steam supplied by the re-evaporation was sufficient to leave only 22 per centum of the quantity generated in the boilers condensed; so that a large portion of the expansion part of the indicator diagram was due to this re-evaporation. The 22 per centum of the steam generated in the boilers, which was present in the cylinders as water of condensation when the pistons arrived at the end of their stroke, were re-evaporated to the condenser under its much less pressure during their return or exhaust stroke, producing no effect upon them.

The heat for the re-evaporation in the cylinders of the water of condensation was supplied by the metal of the cylinders and by the contained heat of the water itself. The metal is first heated during the admission portion of the stroke of the piston by the entering steam which undergoes a corresponding condensation to supply the heat required; and then cooled during the expansion portion of the stroke by the continuous re-evaporation of the resulting water of condensation under the continuously decreasing pressure due to the expansion.

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*From the Journal of the Franklin Institute.

THE VENTILATION OF SHIPS.

No 1.

THERE is no subject of naval hygiene of any approximating importance, and therefore so much really required at the present time, as an efficient system of ventilation of ships. This branch of naval science has been most deplorably neglected all over the world, whereby thousands of lives have been needlessly sacrificed and many millions of pounds wasted.

The chief reason why this and other hygienic reforms have not been effected, is because the essential facts and arguments in its favour have not been publicly notified. It may appear strange, but it is a fact, that we have no book, part of a book, Parliamentary Report, pamphlet, article, or other publication which treats upon the ventilation of ships in any comprehensive or scientific manner, nor can even a quarter of the relevant amount of information upon the subject which it is advisable to communicate to the public be gathered from all the English and foreign books which have been published upon State Medicine on practical hygiene excellent as some of these are. It is also much to be regretted, that no physiologist, toxicologist, or chemist have furnished us with a full amount of the poisonous or dangerous properties of contaminated air within enclosed inhabitated spaces generally which are badly ventilated.

Such being the case, and having carefully studied this subject in all its bearings, we propose to attempt to supply these deficiencies to an appreciable extent, as far as we consistently can, in an article of medium length, by pointing out firstly the composition of pure air; secondly, how it is rendered impure, and its poisonous and dangerous condition within cabins and other enclosed spaces on board ships; thirdly, the indifferent manner in which they are, and fourthly, the system in which they should be ventilated.

Several conflicting statements have been made by scientific chemists and leading hygiests respecting the composition of pure air, but, according to numerous analyses made by Dr. Angus Smith, our greatest authority on the subject, this consists of 20·99 per cent. by volume of oxygen, ·033 per cent. of carbonic acid, and the remainder of nitrogen, watery vapour, and traces of ammonia. Dr. Parkes adds, in his excellent "Manual of Practical Hygiene," 5th ed., 1878, that "perhaps also the most universally diffused salts of soda should be reckoned as normal constituents." From several experiments made by Mr. J. E. Schulze, mentioned in the *Archiv der Pharmacie* [3] ix. 412; it appears that the greatest amount of carbonic acid gas consistent with a healthy state of the air in inhabited rooms, as determined by Pettenkoffer, is under the most favourable conditions generally exceeded. Dr. Parkes says that the amount of air which a man in health requires per hour must be about 2,082 cubic feet, while Grassi, Vierordt, and Valentin have fixed it at 2,118, and Pettenkoffer at 2,120 cubic feet.

In ship cabins and other enclosed parts of a ship not duly ventilated, which contain healthy persons, the air becomes noxious partly by their respiration and the exhalations from their skin, partly from combustion from lamps and candles, and partly from suspended substances; whilst the air of sick cabins is further rendered impure by abundant exhalations from individnals afflicted with illness therein, and from the effluvia of this discharged excretions.

By far the worst impurity in cabins and other enclosed rooms in ships containing healthy persons, is that caused by respiration in which carbonic acid gas and certain unascertained organic substances are thrown off. Dr. Parkes states that the average amount of carbonic acid gas exhaled by a grown up person in twenty-four hours is from 12 to 16 cubic feet, or more according to weight, and H. Amber asserts in Pflüger's *Archiv für Physiologie*, vi. 539, that the carbonic acid which during this time is passed into the atmosphere from the skin amounts to about 4 grammes, and that from the lungs is about 225 times as much. According to Dr. Wilson, one of our most expexienced writers upon preventive medicine, the quantity of watery vapour emitted from the skin varies according to the condition of the atmosphere, and adds that it has been estimated at from 25 to 40 oz. in twenty-four hours, and requires 210 cubic feet of air an hour on the average to retain it in a state of vapour. In 1861, the Barrack Commissioners in their Report upon the Sanitary condition of Army Barracks, state that the proportion of water in a healthy atmosphere should not be less than about half the quantity which the air can dissolve, and it should not, to be wholesome, exceed four-fifths of that quantity. The eminent German physiologist, Hermann, also says that carbonic acid is found in arterial blood on an average in the proportion of about 30 vols. per cent., and that venous blood from muscles at rest, yields about 35 per cent. of such. This acid gas is a powerful sedative poison, and when accumulated in a concentrated form, it cannot be breathed unless much dilated with atmospheric air, as it stimulates the glottis to contraction, and thus causes the person exposed to it to die from suffocation. In several places where carbonic acid gas forcibly escapes from the surface of the ground in large quantities, as in the *Grotto del Cane* of Pozzuoli, in Naples, the poisonous valley of Java, and the Lake of Laach, in Switzerland, both human beings and animals instantly become suffocated. The late Sir Robert Christison, Bart, M.D., quotes a case from the *Journal der Prakischen Heilkunde*, v. 4, 1831, when immersion for 25 seconds in an atmosphere of carbonic acid gas killed an animal outright. Now although some of our continental toxicologists, as Reynault and Bernard, have not thought that this gas, except in a concentrated form, is poisonous, this view, according to Dr. Boehm, another eminent toxicologist, has been entirely contradicted by experiments and researches during the last thirteen years, and the poisonous effect of this gas is therefore no longer doubted.

The amount of organic matter that is said to emanate from the lungs and skin, and which is said to be molecular, and to have a very noxious smell, is supposed to contain small cellular bodies called "putrefaction cells," which closely resemble the so-called bacteriform puncta, which Dr. Macdonald, Professor of Naval Hygiene at the Army Medical School, Netley, has found in foul water. The Barrack Commissioners, in their above-mentioned report say that the animal matter, held in solution by the exhaled fluid, soon becomes putrid after it emanates from the body, "and hence the moisture becomes a vehicle for a subtle aerial poison, which when breathed for a sufficient length of time poisons the blood through the lungs, and so predisposes to disease."

In sick cabins in several cases this organic matter contains puss-cells and other emanations of disease which is continually deposited on the sides and ends of furniture, while the berth clothes which are often prevented from being aired for days are strongly impregnated with the perspiration of diseased patients.

The late Dr. Taylor, our most eminent toxicologist, states in his treatise upon medical jurisprudence that "if a person dies from the effect of carbonic acid ... or of other noxious gases, he is commonly said to die suffocated, strictly speaking he dies poisoned as much as if he had taken oxalic or hydrocyanic acid. The only differences are:—1. That the poison instead of being liquid or solid is gaseous, and 2. Instead of being applied to the mucous membrane of the stomach it affects that of the air cellsof the lungs." Each person, says Dr. Macdonald, should be supplied with 3,000 cubic feet of air per hour to maintain the air of any breathing space in the purest condition which is practically attainable. Nor is it quite clear that both human beings and animals may be poisoned by the carbonic acid which they respire if they remain long enough in a room with contaminated air without proper ventilation. In the "Black Hole of Calcutta" 123 out of 146 prisoners who were confined in that dungeon, 18 feet square, and only provided with two small windows, died the same day they were shut up therein, and one-third of these three hours afterwards. Again, on the night of the 1st of December, 1848, the deck passengers on board the Irish steamer *Londonderry* were ordered below on account of the stormy weather, and the hatches were closed down upon them, notwithstanding that they were crowded into a cabin far too small for them. The dreadful result was that 70 out of 150 of these wretched creatures were poisoned before the morning. By all physiologists it is admitted that re-breathing fœtid matter which emanates from the skin and lungs, produces a putrescence in the blood in proportion to the quantity inhaled and to the time of exposure to its influences. In his "Outlines of Naval Hygiene," 1881, Dr. Macdonald says that "inefficient ventilation which was formerly the rule rather than the exception in ships of war, exerts its influence first on the blood, which is not only imperfectly oxygenated, but rendered still further impure by the absorption of effete matter emanating from neighbouring bodies closely crowded together." Dr. Wilson informs us that in cells at Portsmouth Convict Prison, of 614 cubic feet, always occupied, he found 0·720 per 1,000 carbonic acid gas—the prisoners were healthy and had a good colour. In cells of 210 cubic feet, occupied only at night by prisoners employed outside during the day, he found 1·044 per 1,000 of carbonic acid, the occupants were all pale and anæmic.

It was proved in the Report of the Army Sanitary Commission, issued in 1858, that the excessive number of deaths from consumption amongst soldiers, and in particular regiments, was on account of overcrowding with bad ventilation. Before the enquiry of this Commission the cubic spare for each soldier in the barracks of the Foot Guards was only 331 cubic feet, and the mortality from phthisis was 13.8 per 1,000. But in the Horse Guards, with a space of 572 cubic feet per man, the death rate from consumption did not exceed 7.3 per 1,000. In his treatise, published upon Consumption, in 1872, Dr. Henry MacCormac says, that according to Dr. Granville, no less than 1,900 out of every five thousand deaths at St. Petersburg are attributable to phthisis, as double doors and windows and every interstice are carefully closed with wadded cloth, and exclude the current, and along with the close stove, render stangant utterly the stinted breath and fouled atmosphere, effectively hindering its replacement from without, and in fine entailing the direful scourge of tubercle from which no class or condition of the community finds escape. In the Austrian Capital phthisis prevails to such an extent as to have realized for it the ominous designation of *Morbus Viennensis* . . . . Everywhere throughout the city the most utter disregard is manifested for the commonest promptings of sanitary law, close stoves heat the indescribably stuffy chambers, windows doubly glazed and padded are never opened. Ventilation is a thing never thought of, and as for the clams, health regarded, of the living organism, they are treated with unimaginable contempt" Dr. Parkes says that while cows in close stables frequently die from phthisis or a destructive lung disease (not apparently pleuro-pneumonia) horses whichhave more free air, even in the worst stables, and have a greater amount of exercise, are but little subject to phthisis.

Air vitiated by respiration is also productive of many other dangerous maladies. Thus Dr. De Chaumont in his "Lectures upon State Medicine," properly says that "apart from the determination of specific diseases, such as phthisis, crowding and foul air tend powerfully to increase the spread of all zymotic diseases, particularly those generally looked upon as contagious. It is, therefore, not too much to say that if we could get rid of the effects of crowding, and supply pure air to the community, we might directly diminish the mortality by one-fourth, and indirectly materially assist in reducing it by *one-third*, and this by no means represents all the good that might be done, for it is not only in premature death that the State suffers, but also in the lowered tone of the survivors, whose capacities for productive work are proportionately diminished, and who become the parents of ricketty and useless offspring, little able or willing to keep themselves above pauperism, mendicancy, and crime." Dr. Alfred Carpenter makes some observations to the same effect in his book upon "Preventive Medicine in relation to Public Health," when he states that the testimony of all whose opinion is worth considering, tends to show that strumous diseases "are especially the result of respiring impure air—air which has either been breathed by other persons, or by the same person over and over again, or depreciated by the removal of some of its oxygen by ordinary combustion, without its having been exposed to the purifying influences of fresh oxygen and active motion in the open air." Again, in a published letter upon "the Health of the Royal Navy," addressed in 1862 to Sir John Pakington (Lord Hampton), First Lord of the Admiralty, by Dr. Milny, Medical Inspector under the General Board of Health, the latter says that yellow and typhus fever are both "liable in a confined impure atmosphere to spread by contagion from the sick to the well. . . . By securing an ample circulation of pure air at all times, but more especially from sundown to sunrise, to every one without exception on board a sickly ship, the virulence and extension of the disease would be greatly controlled." He adds that the frequent increase of yellow fever "for the first few days after leaving harbour is doubtless owing to the impeded circulation of air in the between decks principally at night, from the closing of port-holes, &c. Whenever the sick have been treated in tents or under an awning on the upper deck instead of in the usual sick bay, and the between-decks have been kept freely ventilated, salutary effects have been always obtained." The Sixth Report of the Medical Officer of the Privy Council in 1864 also contains some important observations in favour of the probability of a good system of ventilation in the surgical ward of an active hospital preventing the spread of crysipelas contagium, as this would probably be inert by dilation or oxydation before it had spread far from its source if there was sufficient fresh air in the ward, but on the contrary if it was ill ventilated, then the unclean atmosphere would probably abound with the material which the contagium could cause the spread of this disease to other patients in the same word.

(*To be continued*).

THE CARPENTERS OF THE ROYAL NAVY THEIR DUTIES, RESPONSIBILITIES, AND NEGLECTED POSITION.

In our issue of April the 1st of this year we give some account of the above, stating that we would draw attention in future issues to the duties and responsibilities of the carpenter when at sea in charge of a massive and costly hull.

We would first call attention to his duties in connection with the preservation of the hull.

These duties necessitate an accurate knowledge on the part of the carpenter of the whole of the details of the ship's construction and intricate fittings; her watertight and other compartments, construction and working of watertight doors and sluice valves; the pumping, draining, ventilating, fire, flooding, and flushing arrangements, these alone necessitate accurate knowledge of the position, direction, connection and uses of miles of piping, and hundreds of valves, the least mistake in opening or shutting, or wrongly connecting, being of course attended with very serious results. When water is required to be pumped out of the double bottom, or any of the compartments it is the duty of the carpenter to point out which valve to open, or which to shut, so as to make the necessary connection. The carpenter must also possess the requisite knowledge for ascertaining the cubic contents of each compartment, the number of tons of water each compartment will contain, and what effect it would have on the ship's trim, to do which he must be able to calculate the height of the vertical and longitudinal metacentres, and the moments in foot tons for altering trim either fore and aft or athwart ships. He must also know the capacities of all kinds of pumps, area of the pipes, and, with a certain number of revolutions per minute, how long it would take to empty or fill each compartment; also how to ascertain the pressure on each square inch of surface of a compartment filled with water.

He has also the hull of the ship to keep in good condition, that alone requiring constant supervision, in addition to the Quarterly Survey, respecting which circular No. 28 S., 24th April, 1872, par. 7 states:—

"Every accessible part of the outer skin or shell of the ship, of the ribs or frames, and of the innerskin, where there is one, should be carefully inspected in the first week of each quarter. In the event of any dampness or want of anti-corrosive composition, or any other defect being discovered, immediate measures are to be taken to remedy the same, by drying the iron-work, applying fresh composition, cement, or paint, or by such other measures as may be necessary."

We would in the next place call attention to the duties of the carpenter in his capacity as storekeeper.

The stores include everything necessary for repairing and maintaining in proper working order, everything in the ship relating to the hull, except the machinery. It being impossible to enumerate separately every thing in the charge of the carpenter, an idea may be formed of the great responsibility resting on him in his capacity as storekeeper, by giving the total value of the stores, &c., placed in his charge. In doing so, it becomes necessary to compare the value of the stores, &c., and store-allowance of the carpenter with those of the engineer department. In doing this, it is not our intention to under-value the services of the engineer department, but to show that the carpenter, (notwithstanding the improvements in pay and position which are continually increasing with extra requirements in every branch of H.M. Service) is left hopelessly out of any consideration whatever.

The values given as follows are for the smallest class of vessel to which a carpenter is appointed, and for one of our large ironclads,

	Sloop.	Ironclad.
Value of Stores in charge of Carpenter ...	£820	£3,160
,, ,, ,, ,, Engineer ...	£390	£1,730
Store allowance to Carpenter when in charge of stores in a sea-going ship in commission	6d. per diem.	6d. per diem.
Store allowance to Engineer Officer when in charge	2s. 1d. ,,	4s. ,,

It will here be seen that the value of the carpenter's stores exceeds that of the engineer's by £430 in a sloop, and by £1,430 in an ironclad. The store allowance of the carpenter remains at 6d. per diem, whatever may be the value of the stores in his charge; but even this allowance is not paid him unless he is in a *sea-going ship in commission*; whilst the engineer's increases from 2s. 1d. per diem to 4s. per diem *when in charge*. In addition to the fore-going, engineers of every grade receive charge-money, when in charge of engines of ships in commission, varying from 1s. per diem to 4s. per diem, according to the indicated horse-power of the engines.

We will now take the value of the hull of the ship, including fittings, &c., and compare it with that of the engines:—

	Sloop.	Ironclad.
Value of hull, fittings &c., ...	29,400	400,000
Value of engines, boilers, &c., ...	10,000	100,000
Carpenters when in charge of ships in commission	nil	nil
Engineers of every grade when in charge of engines of ships in commission	1s. per diem.	4s. per diem.
Total value of ship stores, &c., in charge of Carpenter; say	£30,200	£403,000
Total value of engines, boilers, stores, &c., in charge of Engineer; say	£10,400	£101,540

Here, again, it will be seen that the value of the ship, stores, &c., in charge of the carpenter exceeds that of the engines, stores, &c., by about £19,800 in a sloop and by about £300,000 in an ironclad; but the allowance to the carpenter still remains at the paltry sum of 6d. per diem, and that only in a *sea-going ship in commission*; whilst the engineer officer reaches a maximum of 8s. per diem, that being paid in all cases *when in charge*.

From the time the ship leaves the hands of the Dockyard Authorities, the carpenter in charge is left to his own resources and knowledge to maintain and keep in proper working order the valuable floating machine that is placed in his care. To do this he must understand building, surveying, and repairing ships, wood, iron, or composite; building, surveying, and repairing boats; making, surveying, and repairing masts, yards, &c., wood, iron, or steel; capstan, oar, and block making; surveying storage, and conversion of timber, knowledge of the qualities and distinguishing features of the different kinds of timber, with their qualifications for special purposes; knowledge of the duties of the shipwright and joiner, caulker, blacksmith, plumber and painter, as these artificers are under his charge, and he is responsible for the manner in which their work is executed.

When on foreign service the carpenter is liable to be, and has been called upon to design and construct storehouses, workshops, bridges, drill sheds, gun carriages. &c., to survey and superintend the repairs of and remast merchant ships; in time of war to construct temporary bridges, roads, and rafts; also the construction of camels or caisoons to float ships over shallows, off rocks, &c.; and coffer-dams to repair damages to the hulls of vessels below the water line,—these very important duties necessitating a knowledge of the principles of merchanics, hydrostatics, hydraulics, specific gravity of bodies and fluids, mensuration of solids and geometrical figures, practical geometry and mechanical drawing. In all cases of emergency the carpenter must be prepared to act and make the most on mechanical principles of the limited means at his disposal, whether in action, or disabled by gales, or in case of fire.

The facts set forth herewith, together with those given in the issue of April 1st, will fully show that any one appointed to the office of a carpenter in the Royal Navy must be possessed of high qualifications, both practical and theoretical, only to be acquired by many years of study and application. That they wear a uniform and keep up the character of an officer of the greatest responsibility on 5s. 6d. per day for the first five years of their appointment increasing to 8s. 3d. per day after 15 years long and trying service, seems too improbable to believe if it were not for the authority of the Naval estimates of pay, &c , on this head.

The Government experience great difficulty in obtaining suitable men to fill up the staff of shipwrights and carpenters in the Navy. Considering the poor pay and still more wretched position offered in return for qualifications of the highest order, which in the commercial labour markets of the United kingdom would command a high remuneration, it is only surprising that men even in small numbers are to be obtained in H.M. Service in this capacity. For years past the Government has been exercised as to the means of obtaining properly qualified men as shipwrights, carpenters mates, and carpenters, but although different means have been tried they are as far from the mark as ever. In concluding this account in a future issue we purpose noticing the methods tried by the Government to raise the standard qualifications of the carpenters, &c., of the Royal Navy, and their utter failures; at the same time giving an account of a movement which is now being made by a combination of the carpenters throughout the service to bring their neglected and deserving position before the Admiralty. The proposed improvements submitted by the carpenters are most reasonable and to the point, and is the only sure method of ensuring the high standard of knowledge and skill and the full complement of hands required in this department of H.M. Royal Navy.

(*To be continued.*)

THE NORTH-EAST COAST EXHIBITION OF NAVAL ARCHITECTURE, &c., AT TYNEMOUTH.

THE OPENING CEREMONY.

THE inauguration of The North East Coast Exhibition took place on the 6th September under the most favourable auspices. Preparations for the successful carrying out of the undertaking had been most industriously pushed forward during the previous two months, and the energy of the promoters, among whom Mr. F. C. Marshall and Mr. George Renwick may be specially mentioned, combined with the large measure of support received from the leading shipbuilders, manufacturers and other influential persons in the North Eastern district have resulted in the Exhibition being a most unqualified success.

Throughout Tynemouth and its vicinity the interest excited on the opening day was intense, and long before the appointed hour immense crowds of spectators had assembled in all the principal places from which a view of the proceedings could be gained.

Shortly before one o'clock the special train conveying the Duke of Northumberland, the Earl of Ravensworth and numerous distinguished visitors arrived at Tynemouth station, and was met by representatives of most of the civic authorities in the district, deputations from public bodies interested in the progress and development of commerce, local members of Parliament, and foreign Consuls. The Earl of Ravensworth, the President of the Exhibition, on descending the steps of the bridge from the train to the platform was greeted by loud and prolonged cheers, and within the passage leading from the platform, where the Mayor of Tynemouth and several members of the Corporation had assembled, his lordship was presented with an appropriate address by the Town Clerk, the Mayor having previously given a hearty welcome to the Town in a few well selected words.

After a suitable acknowledgment by the Earl of Ravensworth, in which reference was made to his lordship's long connection with maritime and industrial matters, a procession was formed outside the station and an advance made to the Exhibition, in the following order:—1st. The *Charles Dibdin* lifeboat, manned by twelve oarsmen and a steersman, all wearing their cork jackets, and drawn by eight splendid horses gaily decked with various coloured ribbons. 2nd. A fishing coble named *The Young Andrew*, belonging to Mr. Taylor of Cullercoats, which was manned and fully rigged with two lug sails and a jib, and drawn by two grey horses. 3rd. The band and boys of the *Wellesley* training ship, to the number of about 230. 4th. The *J. F. Spence* lifeboat, which is stationed at the Long Sands for the assistance of bathers. 5th. The officers and men of the Tynemouth Life Brigade dressed in their blue cloth caps, blue jerseys and white belts, and marching in military order four deep, with a fully-equipped rocket apparatus wagon, belonging to the Board of Trade. 6th. The band of the Tynemouth Artillery Volunteers. 7th. Carriages containing the Duke of Northumberland, the Earl of Ravensworth, Sir W. E Armstrong, Mr. F. C. Marshall, Chairman of the Executive Committee, Mr. Geo. Renwick, honorary secretary, Mr. Joseph Cowen, M.P., Mr. J. C. Stevenson, M.P., Mr. J. Wilson, M.P., the mayors and members of the councils of the boroughs on the North East Coast, and a number of guests invited by the Committee.

The procession was witnessed by many thousands of persons as it passed through the gaily decorated streets, all business having been suspended for the day in conformity with a notice issued by the Mayor.

On arriving at the Exhibition, the President accompanied by the Duke of Northumberland, Earl Percy, and many gentlemen who had assisted in the procession, ascended the platform in the Winter Garden, and after being introduced by Mr. F. C. Marshall, delivered his inaugural address of which the following is an extract.

He said, after some preliminary observations:—

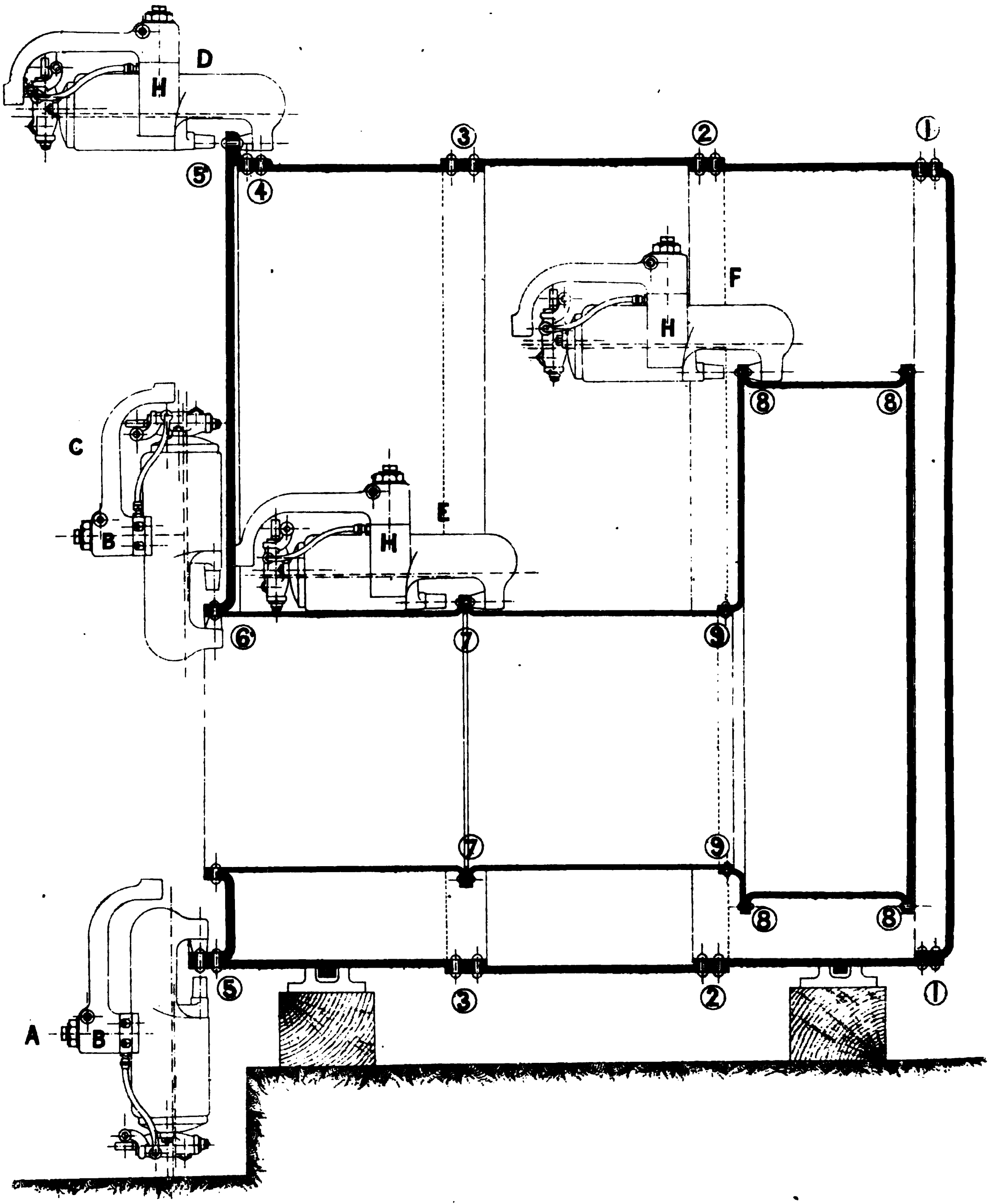
"I may be permitted, in the first place, to cordially congratulate the energetic promoters of the Exhibition upon the choice of the locality. No more suitable locality could have been found than this, which is practically the centre of the great—I might say almost the greatest interest of the North of England—I mean the shipbuilding interest, and all those various trades connected with it. We are within easy access of all the magnificent group of ports, which I may embrace in one phrase and call the north-eastern ports, comprising Blyth on the north, the port of the Tyne, the port of the Wear, the port of the Tees, and extending as far as Whitby on the south. Well, ladies and gentlemen, you all know very well that this mighty industry, this national industry I will call it, has enjoyed for the last four years an almost unprecedented period of prosperity; and I rejoice to think, from all I can learn, that these great ports, and the great sister industry upon the Clyde, are still enjoying that prosperity. I can discover no symptom of a decline in that prosperity. I must further congratulate the executive committee upon having found such an edifice as this for the purposes of this Exhibition. I think it is very satisfactory that they have done so; and when you have had an opportunity of inspecting this building and its contents, and also the contents of the various annexes, you will agree with me that the Exhibition is worthy of their efforts. The first department to which I wish to direct your attention for a few moments is that of naval architecture. By the favour of the Admiralty, we have been furnished with some interesting and almost historical models; and in this particular department you will be able to compare the graceful forms of the old sailing line-of-battle ships—those old wooden walls of England of which we used to be so proud—with those ponderous and iron-cased monsters the modern war vessels, which are certainly more remarkable for their prodigious offensive and defensive purposes than for any peculiar grace and elegance of form, and—standing here in the presence of some able critics—I will venture to add that they possibly lack a little of what I may call uniformity of type. There is a very old saying, and a very true one, that good models are an essential element of the condition of good work; and we also know very well that another essential condition of successful production is the judicious division and distribution of labour. Division of labour is one of those good things which has some drawbacks. It implies, and necessarily implies, a certain monotony of toil, because it involves a certain concentration of mind and energies upon a limited sphere of work, and therefore I think it is of the highest importance that, from time to time, those intelligent classes of our fellow-countrymen—I mean the skilled artisans—should have the opportunity of seeing the completed ship on a perfect and well designed model, and thereby be enabled to judge of and appreciate the value of the individual labour that each man has added to the work. There is, probably, no work in connection with which the division of labour is more usefully applied than the construction of a ship. You have your rivetters and your fitters, your riggers, your ship carpenter, you have the decorator and the cabinet maker, and various other trades employed, and there are also the large class of workmen who are employed upon the more intrinsic portion of the ship—the machinery. I trust the working classes will avail themselves of this opportunity of seeing the models which are exhibited here, and which are the finest specimens of naval architecture. I think the executive committee have most wisely offered to the various workmen, at the vast establishments at the ports I have mentioned, the opportunity of exhibiting their own models and have offered prizes and diplomas to the successful exhibitors on this occasion. You will see exhibited, of course, models of magnificent ocean steamers, which are the wonder and envy of the world. You will see models of yachts of every form, boats of all descriptions, and, in fact, of everything in which our maritime commerce is carried. The next department to which I shall refer is one equal in importance to the department of ships' models—the marine engineering department, which, there is no doubt, will have more attractions for the scientific and instructed people who visit this place. I will only state that, great as has been the improvements effected in recent years in our types of ships, that improvement is small in comparison with the progress and improvement that have been made in marine engineering. It was only at the close of the last century and the commencement of this century that that great pioneer of steam power, James Watt, was content to conduct his ivaluable experiments with a pressure of 15 lb on the square inch Now a pressure of 80 lb., and even 90 lb., and more than that. is to be found in connection with our mercantile steamers. Bear, in mind what this means. This vast acquisition of power has been obtained at a great economy of fuel; and when you remember how universally steam has taken, and is still taking the place of sail, even in the most distant ocean voyages; when you remember the cost of coaling at different ports, and the delay connected with coaling; when you remember further that the more you economise your coal space, the more space you will have for cargo, and the greater will be the profit earned by the ship—when you remember all these things, you will be able to appreciate in some degree the debt we owe to the marine engineer. I will illustrate the triumphs of the marine engineer by referring to one or two vessels. The *Alaska*, which is a steamer built not long ago, and forms one of the Guion line of Transatlantic steamers, performed the voyage across the Atlantic to New York, a few months ago, under seven days. The *Alaska* is not inappropriately called the greyhound of the Atlantic; and she has a sister ship, the *Arizona*, belonging to the same company, and built by the same builders, Messrs. Elder & Co., of Glasgow, and these vessels can be claimed to be the two fastest ocean steamers in the world. The *Alaska* performed the voyage out and home, under rather unfavourable circumstances of weather, in a very few hours over fourteen days. That, I believe, is a feat that had never yet been accomplished in ship travelling. I mention this only to show what I consider are the triumphs achieved by marine engineers. The same firm—Messrs. Elder—are at this moment under contract to build a vessel which will run half a knot faster than the *Alaska*, and I need not remind the engineers around me of the amount of uncertainty and difficulty which arise in getting one knot or half a knot more speed out of a vessel. I hope Messrs. Elder will be successful. The marine engineer has not only annihilated time, but he has defied distance, and brought the most distant parts of the world within the limits of a voyage of a few days or weeks. Presiding over this department is a gentleman who stands at the head of his profession. There is another section which must be of the deepest interest to all of us—I mean that connected with lifeboat work. You are well aware, perhaps better than I am, of the nightly conflicts that are waged with the elements by the noble crews of the lifeboats, and the efficient aid afforded them by the Coast Guard, the very pick of our Royal Navy—aided by all the appliances which do so much in the saving of life, and, I may add, last and not least, by the noble Volunteer Life Brigade, in whose birthplace we are standing at this moment. South Shields, I believe, was the birthplace of the lifeboat, and some twelve years ago Tynemouth initiated the Volunteer Life Brigade. Could a more suitable locality be chosen for an exhibition of lifeboats, and all the gear connected with them, than Tynemouth? I may also remind you that a great ancestor of the present Duke of Northumberland, whom I am glad to see here to-day, the great Duke Algernon, was one of the first supporters of the lifeboat movement, and supported the first designer of the lifeboat which is now in general use. I think that the Lifeboat Institution owes much to the house of Percy. The next department I come to stands side by side with the Lifeboat Institution—I mean the lighthouse department, and all the various appliances which art and ingenuity have invented to minimise the danger of our coasts. Well now, ladies and gentlemen, there is no element, not excepting even water itself, that has afforded to the scientist and to the philosopher, and to the practical engineer, a wider scope and field for experiment in recent years than the element of light. The poets of old, in all the classic imagery of their poetic mythology, were wont to represent the king of the heavens, the father of the gods, seated upon clouds, with a thunderbolt in his right hand ready to hurl the mighty missile at the head of offending mortals or gods, as the case might be; but the modern scientist appears to me to handle the lightning with equally as much readiness and still greater dexterity than Jove himself. It is impossible to say to what use and point this extraordinary and marvellous invention may not reach. It is only a few days ago that Professor Siemens, an able exponent of everything connected with electricity, astonished the world by telling us that before many years have elapsed the forces of wind and wave may be employed to create the very light which is to warn the storm-bound mariner, and guide and lead him into the haven. Science is thus going to help nature herself to protect mankind against her own fury. Surely we live in wondrous times. The marine engineer has annihilated time and space, and now the electrician is going to make the fire from heaven our friend. The electric light has been employed usefully in lighting our coast; and we look to it to light our harbours, our quays, and our streets, and even our line-of-battle ships are lighted by it at this present time. There is no saying to what uses this magnificent light may not be applied. You will see here specimens of the various systems of concentrating and distributing this wonderful light. We find in this county a branch of the invention, and a company formed to carry it out; Messrs. Swan & Co. are prepared at this moment to light our kitchens or our corridors upon the shortest possible notice. All these triumphs of science will be exhibited to your wondering eyes within these walls. I will now allude last, but certainly it is not the least department, to the department which represents the fishermen and all the gear and appliances connected with this trade. The fishermen's avocation has always been, and I fear always will be, a dangerous avocation from the very nature of the circumstances under which it is carried on. I hope that our hardy toilers of the sea will spare a few hours from their toil to visit the Exhibition, if only to see what science and philanthropy combined have done to minimise the risks of their calling. They will see here the best types of boats; they will see the life-jacket, the life-buoy, all the appliances connected with the lifeboat, and the lighthouse: and all those appliances which are exceedingly simple, and many of them extremely effective if employed with calmness and coolness at the right moment; and we know that calmness and intrepidity are leading characteristics of our seafaring population. They will see all these things here, and will, at any rate, give us credit for having done, and for doing, our best, as I said before, to minimise the risks attending their avocation. They will see that which is still more important in regard to the saving of life upon our coasts—the improvement of our existing harbours, they will see what the submarine engineer has done, and they will point with pride, under a summer sun and with a calm sea, to the magnificent piers which have turned a dangerous and a fatal bar into a safe, commodious, and accessible harbour, and have robbed the Herd Sand and the Black Middens of their terrors; and you are going now to reduce all danger to a minimum by erecting a new lighthouse on the inner sand, which has been fatal to more than one noble vessel. They will find our friend, Mr. Messent, an able and consummate engineer, working under all the stimulus given by the Tyne Improvement Commissioners, carrying on the great work of making this a harbour of refuge worthy of the Tyne and worthy of the country. This is a great anniversary. I have been speaking to you about the lifeboat. I am now going to speak to you of the first effort made in the volunteer lifeboat by Grace Darling forty-four years ago. To-morrow is the proper day of the anniversary of the occasion when Grace Darling and her gallant father rescued a great portion of the crew of the *Forfarshire* forty-four years ago, and was the means of suggesting to many people the importance of always having at hand volunteers to save life. I bid you all a hearty welcome within these walls this day. I trust you will find this great Exhibition worthy of your attention and interest, and that will be an ample reward to its spirited promoters."

The Duke of Northumberland, who was received with cheers, said: Ladies and gentlemen,—I have accepted a very pleasant office on this occasion, which is to ask you to testify your gratitude by consenting to a vote of thanks to Lord Ravensworth for his presence here this day, and for the address which he has just delivered to you. I think you will all agree with me that the modesty with which he spoke of the manner in which he was to perform this function was entirely needless. You will agree with me, he has observed a proper course in an address like this to avoid technicalities, which would have been productive of too great a strain upon your attention; while he has shown a grasp of the great subjects which this Exhibition is intended to illustrate which we cannot fail to admire. I say nothing of the language or the manner and the tone in which this address has been delivered to you. I am perfectly sure that you will think he was the right man in the right place, when he was selected as president for this occasion. Turning from the vote of thanks, I will merely say that I trust most sincerely that this Exhibition will be one of national benefit as well as local advantage; that it will not be the last but only the first of many exhibitions of this character, which cannot fail in every way to enlarge the understanding, and increase the capabilities of those who are present at it. I propose a vote of thanks to Lord Ravens-

TWEDDELL'S PATENT HYDRAULIC RIVETTER.

ADAPTED TO THE RIVETTING OF MARINE BOILERS.

(For description see page 163.)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Sprague & Cº Photo-litho.

worth, President of this Association, for the address which has just been delivered.

Sir William G. Armstrong, C.B., said :—My lord duke, ladies, andgentlemen, I have great pleasure in seconding the motion for a vote of thanks to Lord Ravensworth for his address, as well as for his important services in connection with this Exhibition. We are all deeply indebted to those who have devoted their time and their labours to the promotion of this Exhibition, but just as we accord to the general of a successful army the lion's share of the credit, so we must concede to Lord Ravensworth the largest share of our gratitude for the services which have been rendered. I trust that he and all who have co-operated with him will be rewarded by seeing, what I am sure they most desire, a numerous attendance, and a great appreciation of the objects in this Exhibition. If they fail in those objects it will certainly not be for want of proper attraction, for it is hard to say in what department the attractions of this Exhibition are greatest. I am glad to say that in the department of engineering, of which I am most competent to judge, the exhibition of objects is of the most splendid character. In the particular branch of engineering with which I am more directly associated, the display is not perhaps so great as it might be, but you must recollect that my departments are not much connected with marine engineering. However, I may state that my firm has been gradually sliding into shipbuilding, and in a very short time we shall appear as full-blown shipbuilders in combination with that eminent firm that has been alluded to by our president, namely Messrs. Charles Mitchell & Company. It only remains for me to, call upon you to join with me in testifying by acclamation the gratitude that you feel due to our chairman for his address and for his services.

The motion was then put to the assemblage by the Duke of Northumberland, and carried with three cheers.

The Earl of Ravensworth then responded to the vote of thanks, after which Mr. F. C. Marshall introduced to his Lordship representations from the Admiralty, Lloyd's, the Institute of Naval Architects, the Worshipful Company of Shipwrights, Lloyd's Registration Committee, the Institutions of Civil and Mechanical Engineers, and the North of England Mining and Mechanical Engineers.

This brought the inaugural ceremony to a close, and a large number of those present then adjourned to a luncheon held on the lower terrace of the Aquarium in a wooden building temporarily erected for the purpose. The chair was occupied by the Earl of Ravensworth, who was supported on his right by the Duke of Northumberland and Lady Armstrong and on the left by Mr. F. C. Marshall, Earl Percy, and Sir W. G. Armstrong. Mr. George Renwick and many of the presidents and vice-presidents of sections and members of the Executive Committee filled the vice-chairs. After the repast, if such a rough and tumble affair can be called by such a title, and the usual patriotic toasts, Sir William Armstrong proposed the health of the Duke of Northumberland the Lord Lieutenant of the County. His Grace having replied, the noble chairman then gave "Success to the Exhibition," coupling with it the name of Mr. F. C. Marshall.

Mr. Marshall, President of the Executive Committee, who was received with great enthusiasm, said he rose with feelings of great sincerity to thank them for the manner in which they had responded to the toast proposed by the Chairman. It was true, as Lord Ravensworth had said, "that the initiation of the exhibition rested with him; but he must say, in justice to others, that the encomiums passed upon him by his lordship were to a very great extent due to those gentlemen who had associated themselves with him. The success, he might say, of the whole matter to a very large extent depended with their friend Mr. Renwick, the local honorary secretary. It was one thing to initiate a matter, and another and very different thing to work it out. The one was a simple matter of thought and arrangement; the other meant a large amount of close application and intense earnestness and zeal in working out the detail, and he repeated that the success of this Exhibition was to a very large extent due to Mr. Renwick. It would be unjust in making these remarks to omit to mention the enormous advantages they had reaped from the association of gentlemen to whom his lordship had alluded. The presidents of sections of that Exhibition had been most indefatigable in their exertions. It would be impossible for any single individual to have brought about such a magnificent result. When they had persons like Mr. Charles Mitchell, Mr. John Ridley, Mr. Messent, Mr. Adamson, and the various gentlemen connected with the sub-committees under their presidency, all engaged as they had been in the utmost cordiality in bringing about a representation of their industries in the North, it it was very little that one man could do in the whole matter. Therefore, they would pardon him if he disclaimed the high encomiums that his lordship had been pleased in his kindness to pass upon his unworthy efforts. The Exhibition itself largely owed its breadth, its grasp, to the influence of Earl Ravensworth's able presidency and patronage. When he (the speaker) first mentioned the matter to Sir William Armstrong at his office at Elswick, Sir William said he would heartily go into it if they associated with him Lord Ravensworth as representing the Institution of Naval Architects, and Earl Percy as representing the local interests of the county. So soon as these names were mentioned, efforts were made to secure them as vice-presidents. They were secured, and they had as a result a list of vice-presidents that he did not hesitate to say was unequalled by any list of vice-presidents in connection with any exhibition that had ever taken place hitherto in the country. The influence of those gentlemen had been not only general, but also of a personal character. Sir William Armstrong had lent them aid, whenever it had been asked, most heartily and most cordially. Lord Ravensworth, too, had given his assistance. He need not say that as President of the Institution of Naval Architects, his lordship had brought with him a very large following. The result was the magnificent Exhibition which they had in that building. It had been a labour of love in which many hands and many hearts had been engaged, and they had the satisfaction of knowing that day that they had Earl Ravensworth in the chair, they had the Duke of Northumberland, Earl Percy, and Sir William Armstrong with his great character and immense scientific reputation honouring them with their presence. Lady Armstrong, too, had also honoured them with her presence. They had members of all the best scientific institutions of the country present, and he unhesitatingly said that at no exhibition opened or held in the country had there been such a demonstration as they had that day witnessed in the Winter Gardens at Tynemouth. He thanked Lord Ravensworth for the kindly way in which he had proposed his health, and the ladies and gentlemen present for the most hearty and cordial way they had responded to it, and he asked them all to look round the Exhibition and then go and tell their friends to come in order that it might be a great success. Before sitting down he wished to say they owed a debt of gratitude to the gentlemen and the firms on the Tyne, Wear, and Tees, and in fact in the two counties for the noble way in which they had come forward and contributed to the Guarantee Fund, which they hoped would be very much in excess of anything they required. The amount guaranteed amounted to something like £6,500. They certainly did not anticipate that they would need one halfpenny of it, but at the same time it was very noble of the gentlemen who had come forward in such a way, and he might say the Executive Committee had been relieved of a great responsibility by the readiness with which this had been done.

After Mr. Marshall sat down, speeches were delivered by Earl Percy, who gave the toast of "The Exhibitors," which was responded to by Mr. Alex. C. Kirk of Glasgow, Mr. John of Barrow-in-Furness, and Mr. Henry F. Swan of Newcastle-on-Tyne; Mr. J. C. Stevenson, M.P., who was entrusted with "The Visitors," Messrs. W. H. White of the Admiralty, and others replying; and Mr. Andrew Leslie, shipbuilder, of Hebburn-on-Tyne, who proposed a vote of thanks to The Executive Committee.

Mr. George Renwick rising to respond was received with loud cheers. He was glad, he said, to have the opportunity of addressing such an influential company. They had heard from their worthy Chairman of the Executive Committee some idea as to the origin of that Exhibition. He could only say, to verify that, that one evening he was in that building with Mr. Frank Marshall, and on that occasion they were talking about having been at the Exhibition in the Agricultural Hall, in London. Mr. Marshall said to him that he regretted that that place had been such a great failure. He (Mr. Renwick) agreed with him in that view; and, while talking, Mr. Marshall said "What a grand place that would be for an exhibition of the sort that was held in London!" He (the speaker) said it was an excellent idea, and that, if he had strength, he would do his best in the interest of such an exhibition. For the first three weeks of the projected exhibition he carried on the whole of the business in his own office, and for the last three months he had never ceased to do his best to carry out its objects. He could only reciprocate the kind manner in which Mr. Marshall had spoken of him. They had worked harmoniously together, and although they had some little differences of opinion as to detail, they had always one grand object before them—the success of the North-East Coast Exhibition. He did not represent any portion or class of people who might directly benefit from the Exhibition. He was neither an engineer nor a shipbuilder, but he was happy to say he was a shipowner. He believed he was the first man who had ever owned a ship sailing upon the ocean with an ordinary boiler working at a pressure of 150lbs. to the square inch. He did not wish to take any honour on himself for that; all honour was due to the man who designed the engine. He did not wish to say any more on that question. The department of electricity had been entrusted to him. There had been some doubt as to whether or not they would be able to light the Exhibition that night by electricity; but he was now able to say to all present that the electric light would be used in the building at night. He asked them not to forget their worthy acting secretary. He had done his work well and nobly, and had been of great assistance to the Executive Committee. He could only add that he (Mr. Renwick) started that Exhibition with one object in view, that that should not be a small Exhibition, but that it should be the grandest and noblest Exhibition of the class ever held. They had been told by the chief surveyor for Lloyd's agency in London that it was the grandest and finest Exhibition of the class ever held; and he was satisfied.

A vote of thanks being proposed to the President for inaugural address and for presiding over the luncheon, which was suitably acknowledged by Lord Ravensworth, the company then proceeded to examine the various models and other sections of the Exhibition, but so much time had been occupied with what was purely ceremonial, that many of the visitors preferred to put off their inspection to another day.

In the evening a conversazione was held in the Winter Garden, and was fairly well attended. The band of the Northumberland Artillery played on the Terrace, while inside the building was an excellent string band.

THE NORTH-EAST COAST EXHIBITION OF NAVAL ARCHITECTURE, ETC., AT TYNEMOUTH.

THE Aquarium and Winter Garden, situated on the top of the banks facing the sea at the Long Sands. have been selected as the most convenient and suitable buildings available for holding this important Exhibition. In addition, however, to the permanent erections, it was found necessary to provide additional accommodation on account of the numerous applications for space, and the Exhibition Buildings, as actually completed, embrace not only the Aquarium and Winter Garden, but also the Skating Rink and several large and capacious temporary wooden annexes, in all covering an area of about 100,000 square feet. The exhibits have been divided into six sections, viz., Naval Architecture, Marine Engineering, Fisheries and Life Saving Apparatus, and Coast Lighting and Sub-Marine Engineering, containing, with small sub-sections for Workmen's Models, some 650 exhibits.

It will, therefore, be seen that the Exhibition now held at Tynemouth is upon a scale previously unequalled, and though modelled upon pretty much the same basis as the Naval Exhibition recently held at the Agricultural Hall, it far excels it in completeness as well as in the importance of the exhibits.

It is not our intention to attempt a complete description of what the visitor may expect to find in the various sections, but will content ourselves with calling attention to some of the principal exhibits irrespective of the order in which they are catalogued.

The Winter Garden is entirely set apart for models, and here may be found contributions from nearly every large ship builder and ship owner in the country.

The Lords of the Admiralty furnish a number of interesting models of old and new war ships, commencing with the *Royal George*, launched at Woolwich in 1756, and wrecked in 1782 off Spithead, with a crew of 800 men, and finishing with the twin screw turret ship *Devastation* with 12 inch and 14 inch armour, and engines developing 7000 horse-power. Two models of the latter vessel are exhibited, one showing the external form and deck fittings, and the other a section giving details of structure and arrangement of plating and frames, to a scale of 1-24th full size. Besides these there is the *Howe* built at Pembroke in 1860, the *Monarch* launched at Chatham in 1868, and the *Captain*, the loss of which in 1870 with Captain Coles and 454 men will be still fresh in the memories of many of our readers.

Exquisite whole models are sent by Messrs. Caird & Co., of Greenock. Those of the Peninsular and Oriental Co.'s new boats *Ballarat* and *Paramatta*, perhaps attract most attention, though in no way superior to others. These two vessels, which are still in course of construction, will be 420 feet long, 43 feet beam, 36 feet deep, with a gross tonnage of 4,800, an indicated horse-power of 4,000, and a speed of 15 knots an hour.

A great number of very fine half and whole models are sent by Messrs. C. Mitchell & Co., of Newcastle-on-Tyne. This firm is now about to combine with that of Sir W. G. Armstrong & Co., with the view, it is stated, of pushing forward the construction of unarmoured gun boats and cruisers on the system brought out by Mr. Geo. Rendell, and so persistently recommended by Sir William Armstrong. Models of the *Staunch* gun boat and others of the same type up to and including the *Lambda* are shown, also a number of armoured and unarmoured iron cruisers, cattle ships, merchant vessels, etc.

One of the most interesting and perhaps instructive exhibits is that of the Peninsular and Oriental Steam Navigation Company, the description of which in the catalogue is so valuable that we reproduce it nearly *in extenso*. The models and paintings are intended to illustrate the astonishing strides made in ocean navigation since the commencement of the Company's operations in 1837. At this time the contract mail service between Falmouth and the Peninsular ports was started with the small wooden paddle steamers *William Fawcett* and *Royal Tar*. Paintings and particulars of these vessels are exhibited. The former was of about 80 tons old measurement, and 60 horse-power, and the latter about 570 tons, and 260 horse-power. At the time the Peninsular Company expanded into the Peninsular and Oriental Steam Navigation Company in 1840, their fleet consisted of eight wooden paddle-wheel steamers, the largest of which was of 1,670 tons and 450 horse-power, and the entire fleet measured but 7,180 tons and 2,330 horse-power. It is now composed of 48 large iron and steel screw-steam vessels, measuring upwards of 160,000 tons and 150,000 effective horse-power.. The model of the *Tanjore* serves to illustrate the type of mail steamer prior to the opening of the Suez Canal in 1869, and those of the *Kashgar* and *Kaisar-i-Hind* the transitional period, up to the latest additions which are represented by the *Rome* and *Carthage*, and the *Ballarat* and *Paramatta* now in course of construction.

A model of H.M.S. *Black Prince* is shown by Messrs. R. Napier & Sons, of Glasgow, and is interesting as being one of the early ironclads, made at a time when 4½ inch armour was considered a sufficient protection. The same firm exhibit photographs of the triple expansion engines made for the s.s. *Propontis* and *Aberdeen*, the latter employing steam at an initial pressure of 120lbs. per square inch, generated in boilers of the locomotive type.

A chaste and elegant interior for a ship's saloon or smoking-room is exhibited by Messrs. Walker & Lunley, of Newcastle-on Tyne, and attracts a considerable share of attention. It is made entirely of marble, put together as panelling and slightly decorated with incised gold lines. The work shown is for the screw steamer *Anselm*, now being built at Hebburn, and in the evening it is illuminated by Swan's incandescent lamps.

Messrs. Fisher, Renwick & Co., of Newcastle, exhibit a whole model of the s.s. *Claremont*, which, as our readers will remember, broke away from the tug last November, while being towed from the Tyne to Kirkcaldy for the purpose of receiving her engines (see MARINE ENGINEER). This was the first cargo steamer fitted with triple expansion engines, on the Alex. Taylor's system, by Messrs. Douglas & Grant. Photographs of these engines, as also those of the s.s. *Albertina*, which we illustrate in this number, are also exhibited. Messrs. Siemens Bros., of Westminster, send a model of the cable ship *Faraday*, remarkable as being the largest vessel yet made with both stem and stern alike, to admit of steering astern as easily as ahead when laying cable.

A brass model of Kunstadter's screw steering apparatus is shown by the inventor. It consists of a second screw fitted to and working in bearings formed in the rudder itself, motion being communicated through a universal joint to admit of the necessary movement.

The well-known firm of Messrs. W. Denny & Bros., of Dumbarton, exhibit no less than fifteen models. Among them will be found several steamers for the P. & O. Co.'s new fleet, notably the *Clyde*, besides a number of other beautifully finished specimens, all testifying to the wide reputation enjoyed by Messrs. Denny & Bros. Mr. James Laing, Messrs. J. L. Thompson & Sons, Messrs. Pearse & Co., and other builders on the Wear and Tees are well represented by numerous models of both sailing vessels and steamers, as well as of gunboats and corvettes made for the British Government. It is impossible to do more than mention these exhibits, but they are none the less worthy of attention.

Among the miscellaneous exhibits in this section, we may specially draw attention to the fish fin rudders shown, on two half models by the inventor, Mr. George Stavers, of London. The value of prompt steering has now become so fully recognized, that but few large steam vessels are turned out without steam or hydraulic gear of one kind and another; and it is quite possible that further experience may point to the desirability of supplementing the ordinary apparatus with some such device as that of Mr. Stavers. The fin rudders are intended to be applied to the quarters of a vessel to aid the main rudder, or to take its place temporarily in case of serious accident. They are placed below the water line, as close aft as possible, and may be fitted in recesses of the same depth as the thickness of the rudder, so as to avoid projection. When connected up, the fin rudders would be worked by the same gear as the main rudder, the stocks coming through the vessels quarters in stuffing boxes, which would easily be kept tight in the usual way.

A model of the steamship *City of Rome*, now one of the fleet of the Anchor Line, but originally made for the Inman Company, is shown by the builders, the Barrow Shipbuilding Company, Limited. The particulars of this vessel are well known, but we may just perhaps repeat that her length is 610 feet over all, moulded breadth 52 feet, depth of hold 37 feet, displacement 13,450 tons, gross tonnage 8,500 tons, and that she is fitted with three tandem compound engines indicating 10,000 horse-power, supplied with steam of 90 pounds pressure from eight boilers, each 19 feet long and 14 feet diameter.

Messrs. Laird Bros., of Birkenhead, furnish whole models of the *Lily* and *Violet* steel paddle-wheel steamers, built for the express passenger service between Holyhead and Dublin; also a model of the *Huascar*, an armour-clad turret ram, built for the Peruvian Government in 1866. This was the first ironclad vessel on Captain Cowper Coles' system to make a long ocean voyage. She performed important services in the war between Peru and Chili, and was finally captured by the Chilians after a two hours' engagement with the *Almirante Cochrane* and *Blanco Escalada*.

The Orient Steam Navigation Company exhibit models, photographs, and paintings of the *Orient* and *Austraal*, the two latest additions to their fleet.

Palmer's Shipbuilding Company, of Jarrow, J. Wigham Richardson & Co., of Walker, and many other firms of great repute, have also contributed much to make this section interesting both to the general visitor and the specialist, but space compels our passing on to the exhibits in the gallery before bringing our notice of this department to a close.

The gallery, which has been temporarily erected round the Winter Garden for the purposes of this Exhibition, contains a good show of all kinds of instruments, including chronometers, compasses, navigational sounding machines, by Sir William Thomson, barometers, &c., &c.

The Master and Brethren of the Trinity House, Newcastle, show a model of the *Ville de Paris*, the English Admiral's flag-ship in 1795, also one of Lord Nelson's flag-ship *Victory*, made by English seamen from beef bones during their imprisonment in France. There are also models of fishing cobles and life boats, and an interesting picture of the Battle of Trafalgar, painted by Carmichael and Balham.

Mr. Thompson, Newcastle, exhibits a wood model of a slipway for repairing ships, designed by himself and Mr. T. B. Lightfoot, of London, which is successfully in operation in several parts of England and Wales. The chief peculiarity lies in the method of working the links, and communicating the pull to the cradle, this being accomplished so as to obviate the necessity of disconnecting and withdrawing the heavy iron draw bars, as in the older systems.

Messrs. James Coxon & Co., of Newcastle-on-Tyne, have fitted up an excellent representation of a ship's cabin. The interior is fitted with sleeping berths, each bed having a combined wire wove spring mattress, and being arranged so as to be turned up out of the way at pleasure, thereby securing additional room in the cabin. Both exterior and interior is covered with "Lincrusta Walton," the new mural decoration. The cabin is lighted by the Swan Company at night, Ironmongery, medicine chests, pulleys, blocks, sailcloths, and a host of necessary adjuncts both to steam and sailing vessels are shown, and the whole section forms the most complete and instructive exhibition of naval architecture ever thrown open to the public.

In addition to the models illustrating the department of naval architecture, the Winter Garden also contains the exhibits catalogued under sections S and T, which are devoted to coast lighting and submarine engineering. The Masters and Brethren of the Trinity House, London, have furnished a large show of models of lighthouses and lighthouse fittings. Here may be found a model of Rudyerd's Eddystone Lightouse, with sectional painting of same, and a painting of Winstanley's Eddystone—Winstanley's tower was completed in 1699, and destroyed by a storm in 1703, on which occasion Winstanley and the keepers perished, while Rudyerd's tower was completed in 1709 and destroyed by fire in 1755. There are also models of Smeatons' Eddystone, completed in 1759, and showing a light at a height of 72 ft. above high water, spring tide, and of the new Eddystone designed by Sir James Douglass, the last stone of which was set by H.R.H. The Duke of Edinburgh, on June 1st last year. The new light is 133 feet above high water. There is a smaller model of the Maplin iron pile lighthouse, supported entirely on piles screwed 14 feet into the sand, and models of the old and new Goodwin light vessels. The Trinity House has also sent a splendid collection of reflectors and lamps. Among the latter are six and eight-wick "Douglass" burners for consuming vegetable or mineral oils, and giving intensities of 750 and 1,300 candles, six and ten ring "Douglass" burners, giving with 16 candles gas intensities of 600 and 1,500 candles, and showing 5½ to 6 candles per cubic foot, and a new double argand "Douglass" gas burner and 21 inch parabolic reflector, sending a beam of light of about 5,000 candles intensity. The Commissioners of Northern lighthouses, Edinburgh, contribute models of The Bell Rock and of the Dhu Heartach lighthouses, the latter situated on a rock on the west coast of Scotland, exposed to the full force of the Atlantic Ocean, about 14 miles from Iona—the nearest land. They also show one of Mr. Thomas Stevenson's azimuthal condensing ships' lights, designed to distribute the whole light equally over the ten points of the compass in accordance with the Board of Trade requirements, and a model of Stevenson's apparent light to indicate at night the position of a beacon on an inaccessible rock.

A very large series of photographs illustrating the progress of the construction of the New Sea Lock, South Dock, Sunderland, and a number of other important works, is sent by the River Wear Commissioners. There is also a set of eight drawings of their extensive chain cable and anchor testing works, for which the machinery was made by Messrs. John Abbot & Co., Limited, Gateshead, and several working models, among which we may specially mention the "Wear" single ladder open-ended dredger, capable of lifting 600 tons per hour, and which is shown in motion by means of an electric apparatus worked from a battery below. This dredger was designed by Mr. Henry Wake, C.E., and constructed by Messrs. Hanks, Crawshay & Co., Gateshead, and is 130 ft. long, 32 ft. beam, 10 ft. 6 in. deep, and draws about 6 ft. 6 in. of water. The ladder works through a well in the centre of the hull, which is open at the bow end. The machine is capable of dredging in any depth of water, from about 6 ft. 6 in. to 31 ft.

The River Tyne Commissioners furnish an exceedingly important exhibit, which will be specially interesting to those who are acquainted with the works carried on in recent years at the mouth of the Tyne. Most conspicuous is a working model of a mammoth crane now being erected for placing the large blocks of concrete for the North Pier Extension. It is to be capable of lifting 40 tons at a projection of 75 ft., and is partly being constructed by the Commissioners themselves, and partly by Messrs. Stothert & Pitt, of Bath. To those engaged in the shipment of coal, Messrs. Messent & Ward's proposed anti-breakage system will be viewed with interest. By this plan travelling buckets strung close together on an endless chain, would receive the coal as it leaves the spout, and by means of suitable tumblers and guides would carry it to the bottom of the hold, where they would be automatically tipped and returned again to be re-filled. A scale model shows the high level road and railway bridge over the Tyne, and the swing bridge recently erected by the Commissioners.

Sir W. G. Armstrong & Co., of Elswick, exhibit a model of hydraulic hoist and train of boats in use for shipping coals on the Aire and Calder navigation. This system was devised by Mr. W. H. Bartholomew, and consists of a train of boats hinged together and propelled by steam, each boat carries about 40 tons of coal, and is lifted bodily out of the water by the hydraulic hoist, and its contents tipped directly into the vessel to be loaded.

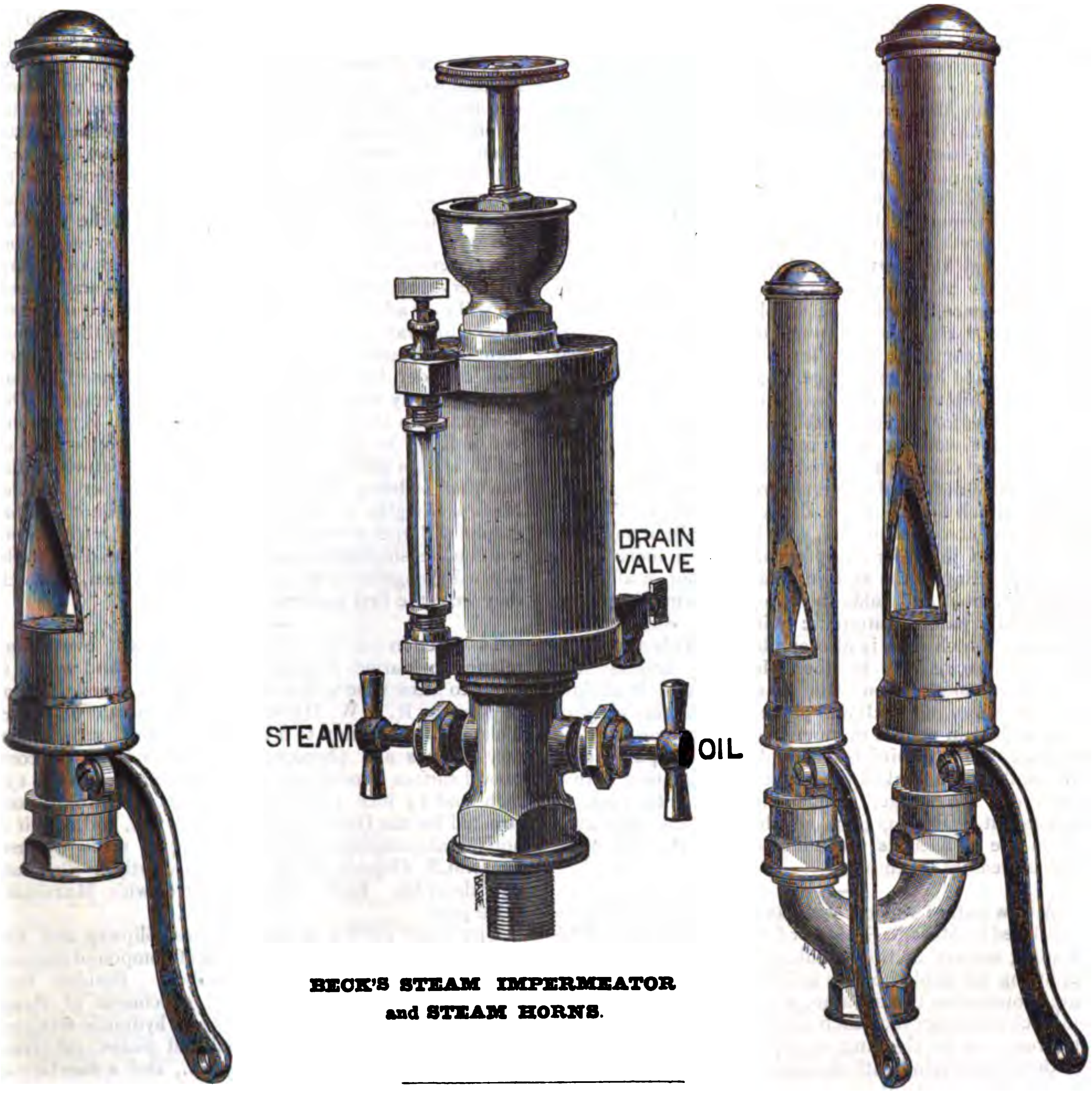
Excavators of a well known type are shown by Messrs. Priestman Brothers, of Hull, actual machines being in operation on the sands in the enclosure in front of the Winter Garden, while models are exhibited in the gallery.

Messrs. Chance Brothers, of Birmingham, send several lenses and lights, among which may be mentioned a dioptric holophotal lens of the sixth order, as used in connection with the electric lights on ships of war and in forts, for defence against torpedoes and other purposes, with diverging lens for occasional use to increase the illuminated arc by about 20 degs.

A model of a large twin screw patent hopper barge and dredger, to carry 1,500 tons of spoil, is shown by Messrs. W. Simons & Co., of Renfrew. The engines are of 150 nominal horse power, and are capable of propelling the vessel at a speed of 8 miles per hour. The ladder is arranged to work in any depth of water from 5 ft. to 35 ft., and will lift 500 tons per hour.

A diving bell, in which visitors may descend on payment of one shilling per head, is lent by the River Tyne Commissioners, and shown in a tank especially instructed for the purpose. The air pumps are driven by one of Clayton's patent vertical gas engines, exhibited by Mr. J. A. G. Ross, of Newcastle.

Messrs. Beck & Co., Limited, of Great Suffolk Street, Southwark, are well represented at the North-East Coast Exhibition, Tynemouth. This firm is well known for its gun metal fittings, valves, and hydrants for water and steam, of which many examples were on exhibit at Tynemouth, as well as Chanoit's Patent Aërating Filter for ships and domestic use.



BECK'S STEAM IMPERMEATOR and STEAM HORNS.

We select for illustration a steam impermeator and steam horn as of especial interest to our readers. The steam impermeator is well known as the most efficient instrument for conveying oil to the cylinder by the thorough impregnation of the steam by it. To charge the impermeator, close both the valves at the bottom marked "steam" and "oil," then open the small air valve at the top of the glass gauge, which allows the air and steam to escape, then open the top valve, and fill up the impermeator to the top of the glass. Shut the top valve and small air valve, open the valve marked "steam" one full turn, then open the valve marked "oil" gradually until you see it beginning to feed, then adjust the valves according to the quantity of oil the cylinder requires. One filling will be sufficient for 24 hours constant working.

The steam that condenses in the cup enters the steam pipe along with the oil, and prevents it being destroyed when it comes into contact with steam at a high temperature.

The steam horns we also illustrate, of Messrs. Beck and Co.'s manufacture, are well known in the market as of a good and penetrating tone, and of first-rate workmanship.

MESSRS. HARFIELD & Co., of London, have sent a large collection of windlasses and capstans, all of them of exceedingly compact, strong, and good design; and we may specially mention the patent steam engine worm wheel windlass with warping capstan, for working 1¾ inch cables. Unlike most windlasses, this machine has a vertical steam engine, an arrangement which enables it to be got into very little space. From the engine the power is transmitted by a pair of mitre wheels to a horizontal shaft, which drives the cable lifters by a worm and wheel, and also the warping capstan, which, being vertical, can be placed in any convenient position, either on the same deck or on the forecastle. Screw bars, of the usual construction, brings into action either one or both drums, but instead of friction cones, Messrs. Harfield employ compound disc brakes, giving great power of holding and facility for letting out the cable by a very small movement of the nut. Another feature in this machine is the manner in which the cable is led on to the drum at the bottom, and over the top in such a manner as to embrace nearly seven-eighths of the circumference, while the cable is at the same time kept close and snug to the deck. Harfield's patent side pipe lever windlass with gear to be worked by a messenger chain from steam winch, is also exhibited, and a patent capstan with wrought iron body for 1½ inch cables, with patent portable whelps for working wire rope. In connection with messenger chains a special scarf joint shackle has been designed, and several are shown. They are pretty much like slightly enlarged links of an ordinary chain cut across each side, with biting edges, as in the usual scarf joint for pump rods, while a loose piece corresponding to the stud in a cable is put in after the joint is closed and holds the two parts firmly together. Harfield's patent automatic wire rope stopper, for working 3-inch rope is also exhibited. This apparatus is used exclusively by the Admiralty, and is very simple in construction while most effective in action. It consists of an inclined plane running on a set of live rollers in such a manner that the grip on the rope is increased or diminished according as the pull varies. A small pinion worked by a lever, and gearing with a rack on the wedge, brings the grip into play or releases it. The top grip, which, when the apparatus is in use is fixed, is made movable, so that the rope can be readily taken out.

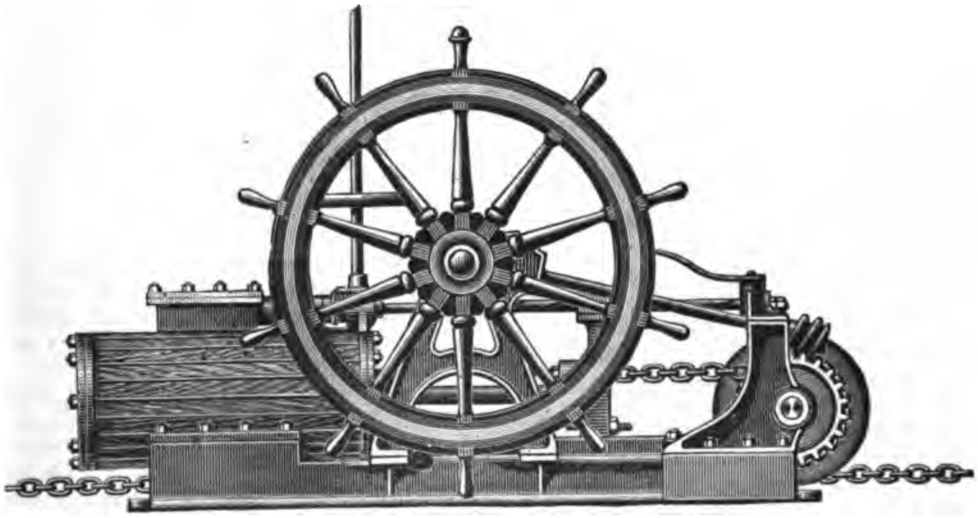
A NEW patent vertical windlass for 1⅝ inch cable, is exhibited by Messrs. S. Baxter & Co., of London. The leading feature in this windlass is the novel method of fitting the cable holders and friction brakes. These are mounted on two separate vertical spindles or shafts in such a manner that each cable holder and brake can be removed for cleaning or repairs in a few minutes, without interfering with the other parts of the windlass. Among other advantages may be mentioned the small height of the chain above the deck, which enables the whole machine to be kept very snug and compact. Further, the chain having nearly a whole turn upon the cable holder, the risk of its over-riding the stops or whelps is removed. This firm also shows a newly patented fitting, called a "Dwarf Capstan," for heaving and holding wire rope hawsers. The body of the capstan resembles a sheave, lying horizontally, and having a waved groove running round it. The hawser is put in this groove and is held by the waves, about half a turn round the sheave giving enough "bite." The capstan is pawled or held by friction brakes similar to those used in the windlass first alluded to.

A NEW type of Lightfoot's patent dry air refrigerator is shown in operation in connection with a cold storage chamber, by Messrs. Douglas & Grant, of Kirkcaldy, the manufacturers of this machine. It is arranged to be driven by belting from a gas engine or from any available source of power, and has been designed specially for cooling provisions either on board ship or on shore, and for the use of butchers, fishmongers and others to whom a ready means of obtaining cold would be a great boon. The same machine may be made to any size, and may be driven either by a belt, as in the present exhibit, or may have a steam engine combined with it on the same bed, as shown in the photographs on the walls of the cold chamber. The method of cooling air upon this system is now so well known that it is not necessary to enter into a detailed description of the apparatus, and we will only add that the efficient action of the moisture abstractor was made manifest not only by the almost complete absence of snow in the air as it left the expansion cylinder, but by the quality of condensed vapour running away as water from the discharge traps. The workmanship is excellent, and all parts seem very strong and well up to their work matters, the importance of which are not easily overrated. The speed at which the machine is being driven is 150 revolutions per minute. Messrs. Douglas & Grant also show excellent photographs of large size of Lightfoot's dry air refrigerators with condensing steam engines combined, and of triple expansion engines on Mr. Alex. Taylor's system, of which they were the first makers.

IN Section 2, in which is classed everything relating to Marine Engineering, the first stand which is likely to attract the visitor on entering the annexe, is that of Messrs. R. & W. Hawthorn, of Newcastle-on-Tyne. This firm, in addition to a number of small supplementary engines and photographs, has sent a pair of compound surface condensing twin screw engines, with 13½ inch and 24 inch cylinders by 12 inches stroke, constructed for the Danish gunboat *Gronsünd*, and a pair of horizontal compound surface condensing screw engines for H.M.S. *Dolphin*, which we hope shortly to illustrate and describe. Each engine is fitted with Marshall's valve gear.

THE chief exhibit of the Wallsend Slipway and Engineering Company, Ld., is the pair of compound engines illustrated in our present number. Besides this, however, there are several good specimens of flanging and stamping by Tweddell's patent hydraulic flanging machine, several examples of injured plates, cut from vessels repaired by the Slipway Co., and a number of models, photographs and drawings. Among the latter are a design of a triple expansion engine on Mr. A. Taylor's system, in course of construction, and plans of engines and boilers of 1,700-horse power indicated, for a steel vessel now building at Messrs. C. Mitchell & Co's. for the Russian Steam Navigation Co., Odessa. The cylinders of this engine will be 40 and 78 inches diameter and 48 inches stroke, and the working pressure of steam 80lb per square inch.

The accompanying cut shows the forward elevation of N. Taylor's Combined Hand and Steam Steering Gear, which is of the direct acting type, *i.e.*, the helm is moved over the desired arc by one stroke or less of the steam piston. In this arrangement the tiller chains are applied to a drum or barrel which can be connected to the steam power or hand power as desired, by a clutch provided for that purpose sliding upon the drum shaft; on the forward side of this clutch is the worm wheel and tangent screw seen in the engraving. This system of transmitting the hand power to the helm effectually secures the steersman against injury when a sea strikes the rudder—as he cannot be thrown from the wheel. On the after side of the clutch is a pulley rotated by a chain attached to the piston rod crosshead, the steam cylinder is of the ordinary kind, the admission being regulated by an ordinary D slide valve. The valve gear consists of a long nut mounted in a suitable carriage, which allows it a combined rotary and sliding motion. One end of this nut is tapped left handed to receive the slide spindle, and the opposite end is tapped right-handed to receive the end of the rifled bar, which is driven by a suitable nut on the piston rod crosshead, a horizontal hand wheel on the spindle carried up through the flying bridge gives motion to this nut. The action of the valve gear is such that any movement of the hand wheel to port or starboard gives a corresponding movement of the slide valve in direction and proportionate quantity, the movement of the piston under the steam so admitted, continuing until the rotation of the rifled bar has brought the slide valve back to its normal position. It will thus be seen that there is the most complete command over the movement of the machine under steam, and that compared with those rapidly moving steering engines which are only modifications of the steam winch, its motion is sufficiently slow to free it from the noise and vibration which are such objectionable features in steering engines.



N. TAYLOR'S COMBINED HAND and STEAM STEERING GEAR.

Much attention is being devoted now-a-days to inventions for giving security in sudden emergencies to life at sea. Mr. George Tyzach of Corkson's Quay, South Shields, exhibited at the North-East Coast Exhibition, Tynemouth, an excellent combination of life-buoy, travelling valise, and hat-case, which is well worth the attention of travellers.

Everyone who is accustomed to travelling by sea will be fully alive to any multiplicity of boxes or cases, and any single valise which is specially adapted to a variety of purposes, and to the greatest possible accommodation, will be hailed as a great boon. If there is one article of dress more than another that offers the greatest difficulty to packing, it is the modern tall silk hat. The traveller is usually reduced to carrying a special hat-box for it, which is entirely innocent of any further value or use.

The "Combination" is about 22 inches long, by 12¼ by 9½, entirely obviates the necessity of carrying any other receptacle for the hat, and at the same time it will contain, cuffs, collars, a suit of clothes, a change of under garments, a pair of boots and a dressing case.

It is oval in shape, and is provided with a strong leather strap for carrying at the side or over the shoulders, as may be desired.

Its most special feature is its adaptability as a life-buoy. If made of steel it requires no further alteration for this purpose, but has naturally sufficient floating power to support two persons. If made of leather, the interior contents must be removed, and an india rubber bag inserted and unflated, when the valise will be rendered buoyant. The india rubber bag will be found also useful as a sleeping pillow in railway travelling.

A large pair of triple expansion engines is shown by Messrs. J. Wigham, Richardson & Co., of Walker, but as we hope to illustrate them in a future impression, we defer giving any description till then.

MESSRS. HIGGINSON & CO., of 30, Mersey Street, Liverpool, exhibited a Steam Steering Gear which they call, "The Steam Quarter-Master." This machine which attracted much attention, and was the subject of many favourable comments, is the ordinary hand gear worked by steam power, the engine being drawn upon by the helmsman for exactly the amount of steam aid he requires. The man and engine work together as may be necessary, in which case there is an instantaneous change from hand to steam and *vice versâ*. The feed and cut off are operated upon automatically when under steam by merely moving the hand wheel, which gives both direction and force from half a link to full helm, while the engine cuts off the steam just as hard over is reached. In short the "Steam Quarter-Master" puts the helm hard over in five seconds, and cuts off its own steam. Connections for steering with this machine from the pilot's bridge can be fitted. Many of them have been sold and give great satisfaction, and alongside of the machine exhibited we observed a very well finished "Steam Quarter-Master" which was made for the King of Siam, to the order of Messrs. Wigham, Richardson & Co.

IMPROVEMENT in the use of telegraphic apparatus on board steam ships are always immediately appreciated, and their utility and advantages are inestimable. It was, therefore, with much satisfaction that we noticed the exhibits of some important appliances for this purpose at Tynemouth, furnished by Messrs. Chadburn & Sons, of 73, Lord Street, Liverpool, consisting of patent mechanical reply engine and steering telegraphs and other marine engineering instruments. To the former was awarded the only medal at the Paris Exhibiton, 1878, and they have been fitted on board 2,500 vessels of various Companies, including those of the leading lines of passenger steamers, besides on ships of the British, Russian, German, Austrian, Portuguese, Italian, Brazilian, Dutch, Turkish, Chilian, Chinese, Indian, Japanese and Argentine Republic Navies: they have also been fitted upon Channel Steamers, Ferry Boats, and Steam Yachts. These facts speak volumes in favour of this new invention and require no further comment to add to their estimation.

THE use of fresh water condensers on board ships was conspicuously manifested shortly after the recent bombardment of Alexandria, when our soldiers and marines were much indebted for their supply of drinking water from these receptacles. It was therefore, satisfactory to learn that the apparatus exhibited by Mr. E. Suffield, of Devenport Street, Commercial Road, London, of a 750 gallon Fresh Water Condenser and some small condensers for steam yachts were very favourably noticed. It is to be hoped that they will be used to far greater extent than they have been, in accordance with the increased requirements of naval hygiene.

CONSIDERING the great additional usefulness of good [illegible] of glues, varnishes, and pitch for application to [illegible] of many parts of ships, the im[illegible] articles, shown by Hoy's Patent Waterproof Glue and Enamel Co., Portsmouth, are entitled to much commendation.

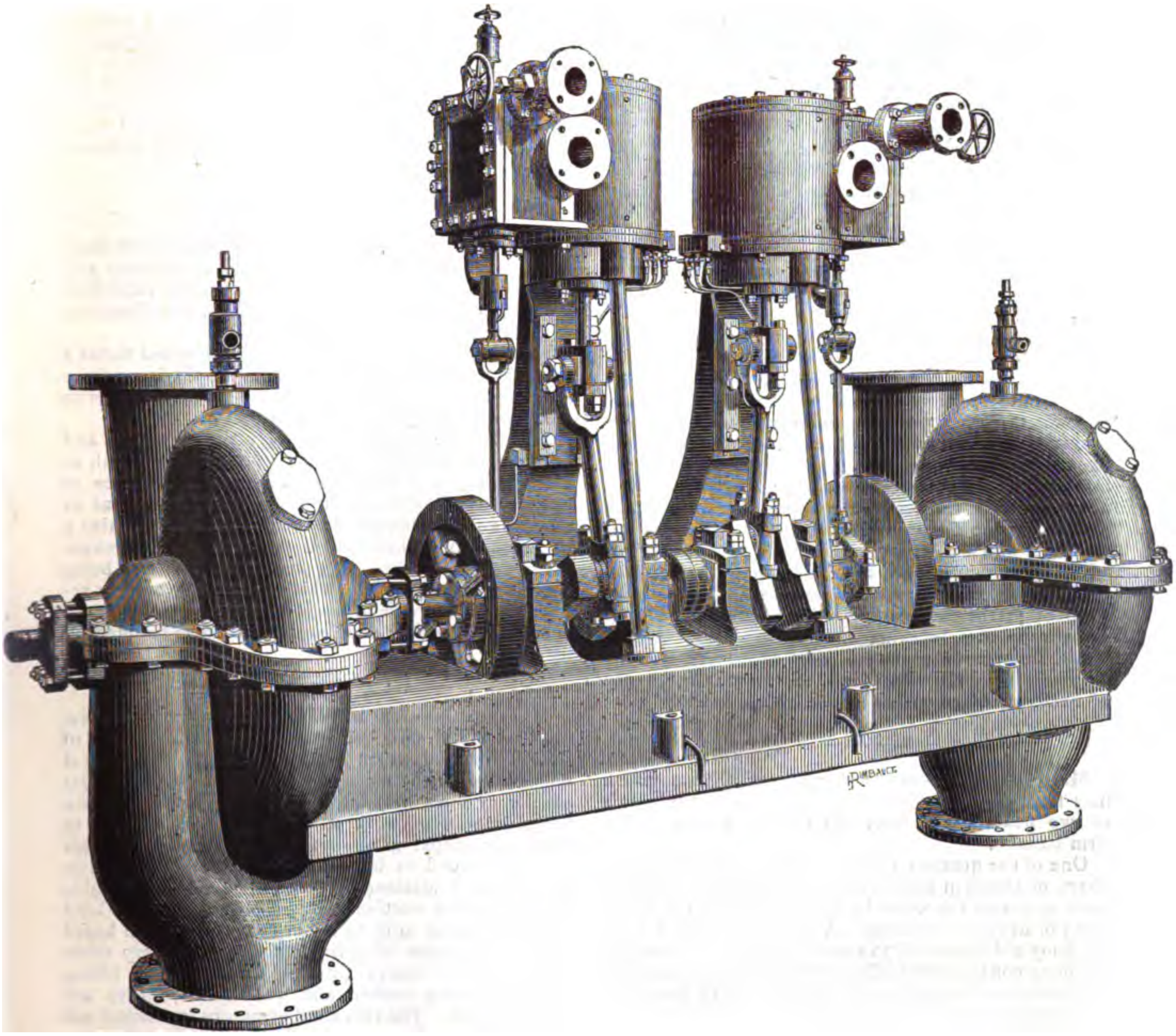
THE numerous mechancial appliances exhibited by the Phosphor Bronze Co., 87, Sumner Street, Southwark, London, S.E., received their fair share of attention, which will probably cause a great number of them to be used. They consist of various kinds of beam bearings, piston rings, bolts, worm wheels, pinions, revolvers, guns, valves, phosphor brass fittings, steam fittings, samples of tubes, wire rods and steel, prize medals and awards.

MESSRS. WALTER C. CHURCH & CO., LIMITED, of London, show models and parts of Church's patent circular balanced slide valves, which we illustrate by two sectional views on page 186. The construction of the valve is well shown by the engravings, which give true modifications of the invention. Upwards of 300 of these valves are now fitted to engines in various parts of the country, and they appear to give entire satisfaction, both as regards economy in steam consumption, and diminution of wear and tear, as compared with the ordinary slides. In addition to the ordinary reciprocating motion, the slide has a turning movement given to it at each stroke, so that fresh portions of the rubbing surface are continually being presented to each other.

MESSRS. JOSEPH ADAMSON & CO., of Hyde, near Manchester, show some excellent examples of boiler work, in the shape of flanged and welded flue rings, and in addition exhibit a novel design of boiler which they have christened the "Convector." This boiler consists of two water chambers united by two circular concentric rows of water tubes which encircle the furnace and form the firebox. There is no water space round these tubes, but only a casing, which it is stated does not attain an excessive temperature, as the tubes protect it from the heat. A continuous circulation of water takes place between the two water chambers, the current passing down the outer row of tubes and rising up the inner one which is more directly exposed to the fire. The boiler is suitable for generating steam for all supplementary purposes on board ship, and is, the makers state, the only vertical boiler in which the grate surface is in du proportion to the heating surface, the ratio bein similar to the best marine practice. In proof of thi they state that ten pounds of water can be eas evaporated with one pound of coal of fair quality.

A GOOD exhibit is made by the Pulso Engineering Company, Limited, of London, who a great many different sizes of pulsometers for u board ship for pumping tanks and bilges, circu water for condensers, extinguishing fires, a washing decks. There is also a model showin this simple contrivance is to be fitted on boar as well as an actual machine working under to illustrate its application to the draining tanks, &c.

On this page we give an engraving of a pair of centrifugal circulating engines and pumps, the last of an order for F. & G. Thomson, of Glasgow, which are exhibited by the manufacturers, Messrs. W. H. Allen & Co., of Lambeth. These pumps are, together, capable of delivering 5,000 gallons of water per minute, and are arranged that either engine can be used for driving either pump. The framing is cast in one piece with the bedplate, the lower part of the pumps and the crank shaft bearings, and is of very graceful form. The cylinders, which are carried by the frames, as well as by strong vertical steel stays in front, are each 9 inches diameter and 8 inches stroke, and are intended to work at a speed of 240 revolutions per minute. All piston and connecting rods are of forged steel, as well as the crank shaft. The bearings are of manganese bronze all carefully fitted with lubricators, and the pump spindles are of forged manganese bronze. Between the engines is a coupling, which permits a slight divergence between the two shafts, in case the bearings should wear unequally. It is formed by two ordinary face couplings, with a key-way cut radially across each, with which is fitted a key held in place by a couple of set screws tapped into the coupling. Altogether these engines and pumps illustrate in a remarkable degree the great care bestowed by Messrs. Allen in designing their work, while the finish equals anything we have ever seen in this class of machinery, and reflects great credit upon all those concerned in its production.



W. H. ALLEN'S CENTRIFUGAL CIRCULATING ENGINES and PUMPS.

MR. T. BASSNETT of 10, Bath Street, Liverpool, exhibited a good specimen of his patent engine reply telegraph instruments, compasses of improved description, and binnacles, &c.; but his best show was his improved patent acoustic machine, which is one of the most economical and simplest instruments for sounding which we have noticed. Its construction is tubular, and acts by the pressure of the water, which enters a small valve at the base. The water is raised in the tube by the pressure, and its height is perceived through a slot which extends some distance from the top. An accurate reading can be taken from a side index scale on the tube, and the water is then released through the bottom valve. The excellent testimonials received respecting the thorough efficiency of this patented invention say very much in its favour, and will probably cause it to be extensively adopted, as it has been for some time in a very satisfactory manner on board the *Germanic*. The important use of the apparatus was further evidenced by the lecture upon it, which he delivered during the exhibition, and we hope that he will soon have a very successful sale of it, which will at once be appreciated on being tested.

IN Section 2—No. 192, The Hartlepool Ropery Co., Limited, exhibit a handsome case of samples and sections of wire ropes for mining and shipping purposes, so arranged as to show at a glance the comparative sizes of equivalent strength of ropes manufactured from the various qualities of iron and steel wire. Also a very compact reel for storing ships' hawsers, entirely dispensing with the usual crank handles. This reel is furnished with a 3¼ inch flexible steel hawser of superior make, and is guaranteed to be fully up to the required standard of Lloyd's tests viz., 22 tons. Also a 3 trawl warp of patent flexible steel wire equal to an 8½ inch hemp rope of a breaking strain of 18 tons. Also a block, fitted with a patent .steel strop, and flexible steel halyards for fishing boats, and various specimens of neatly executed splices in steel ropes, &c.

MR. JAMES LINKLATER exhibits at Tynemouth a new form of life raft or life buoy. It is in the shape of two boats joined over the top by two light but firm battens.

One of the greatest values attaching to the peculiar shape of the twin buoy is that it can be propelled with such ease over the water in the direction of the struggling or drowning person. A single shove will send the buoy a distance of 30 yards in a straight line, and the buoy consequently offers little or no resistance to a swimmer who is taking the buoy out with him to a drowning person.

This apparatus may be increased in size, so as to support 300 people, and which can yet be packed into a sufficiently small space to occupy no more than that of one 12 foot boat.

A test carried out to give a comparison of the ease with which different forms of life saving apparatus could be thrown or sent to a drowning person, resulted in the success of Mr. Linklater's apparatus over all others.

THE relative stiffness or crankness of vessels depends very much upon the different qualities of cargoes and their method of stowing. It is of the utmost importance that any captain should know the qualities and action of his vessel with different cargoes, and with arrangements of stowing, but at present he has no exact means of arriving at this knowledge.

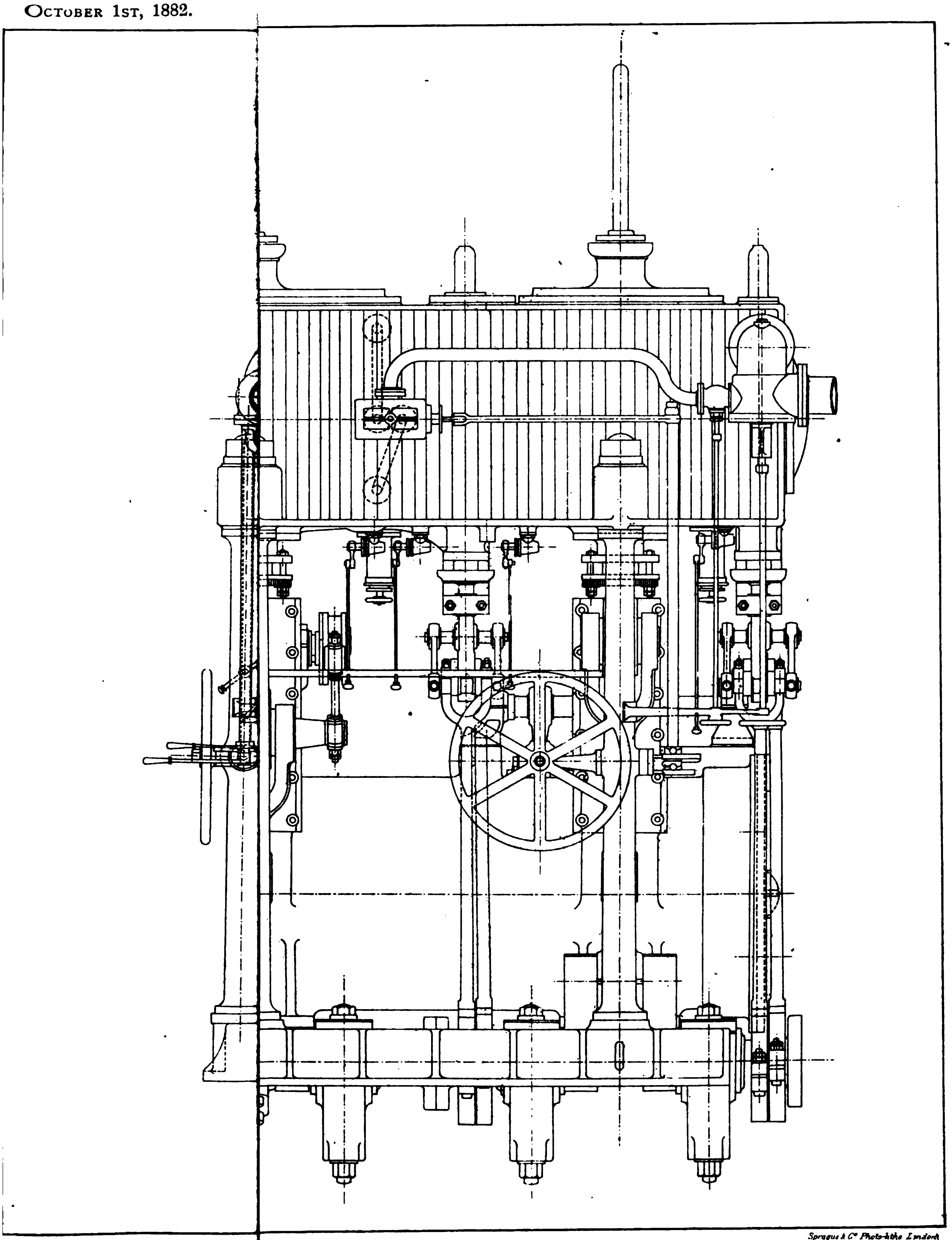
Mr. Alexander Taylor has invented an arrangement consisting of two gauges connected with a tank of water. The list of the ship under any conditions is definitely indicated by the .level of the fluid in the gauges. If then a log is kept by the captain of the action of the ship with a light cargo in bulk or with a heavy cargo of iron, he can ascertain by direct experiment under what conditions of stowing for different cargoes his vessel is in the best trim.

AN Exhibition such as that at Tynemouth is most valuable as attracting attention to all that is new and useful, and certainly one of the most novel exhibits is the Patent Mica Grease of the Mica Lubricant Company of South Shields.

Mica it seems when prepared and pulverized forms a valuable natural lubricant; it fills up all the inequalities and roughnesses in metal surfaces, and when mixed with grease forms a most perfect lubricator.

Mica has the property of giving a special surface and polish of its own to the rubbing faces of the metal, so that the bearings so formed have the appearance of highly finished electro plating, and are so hard that in time it is almost impossible to file them. It is also a non-conductor of heat, and is also practically indestructible by acids or heat. This prepared mica is also being applied to a new packing which is being favourably received. This grease is not a liquid lubricant like oil, but is semi-liquid, and fed to the bearing as required by the rise of temperature.

MESSRS. CARRICK & WARDALE, Engineers, Gateshead, at Stand No. 90, Section E 2, exhibit three of their celebrated steam pumps at work. The largest one is capable of pumping 40,000 gallons per hour. Its excellency does not, however, entirely consist in the large amount of work it will do, but in addition to this, any chips, grain, waste, or other substances generally found in bilges, do not affect its efficiency. This result is attained by the use of a D slide valve to regulate the suction and delivery. Now this kind of pump seems to us to be highly essential on board ships, as in case of springing a leak, it very often happens that pumps fitted with mushroom lifting valves, become choked and useless when they are most needed. The two smaller pumps exhibited are of a similar construction, and the quantity of water they pump is perfectly marvellous. They also exhibit specimens of their air compressors, boiler testers, and high pressure pumps, to pump against a pressure of 1000 lbs. per square inch. The quality of the workmanship, and the carefully worked out designs of their exhibits are quite in keeping with the reputation they have established in all branches of their business.



Sprague & Cº Photo-litho London

Racing on board steam ships still continues to be one of the most fruitful causes of disaster to propellers, to shafts, or to the engines. No machinery is subject to sudden breakdowns except under violent shock. The ordinary governor which is dependent upon a noticeable increase in the velocity of the engine before it operates to cut off the supply of steam, is useless to check "racing," as it first allows that racing to take place before it can fairly operate. This is well known to all sea-going engineers, but, hitherto, there seems to have been no reliable governor independent of the engine submitted to their notice. The illustrations herewith of Messrs. Smith & Pinkney's Atmospheric Pendulum Governor, will clearly explain the action and construction of a governor which is operated by the pitching of the vessel, and is thus admirably calculated to entirely check racing by anticipatory control.

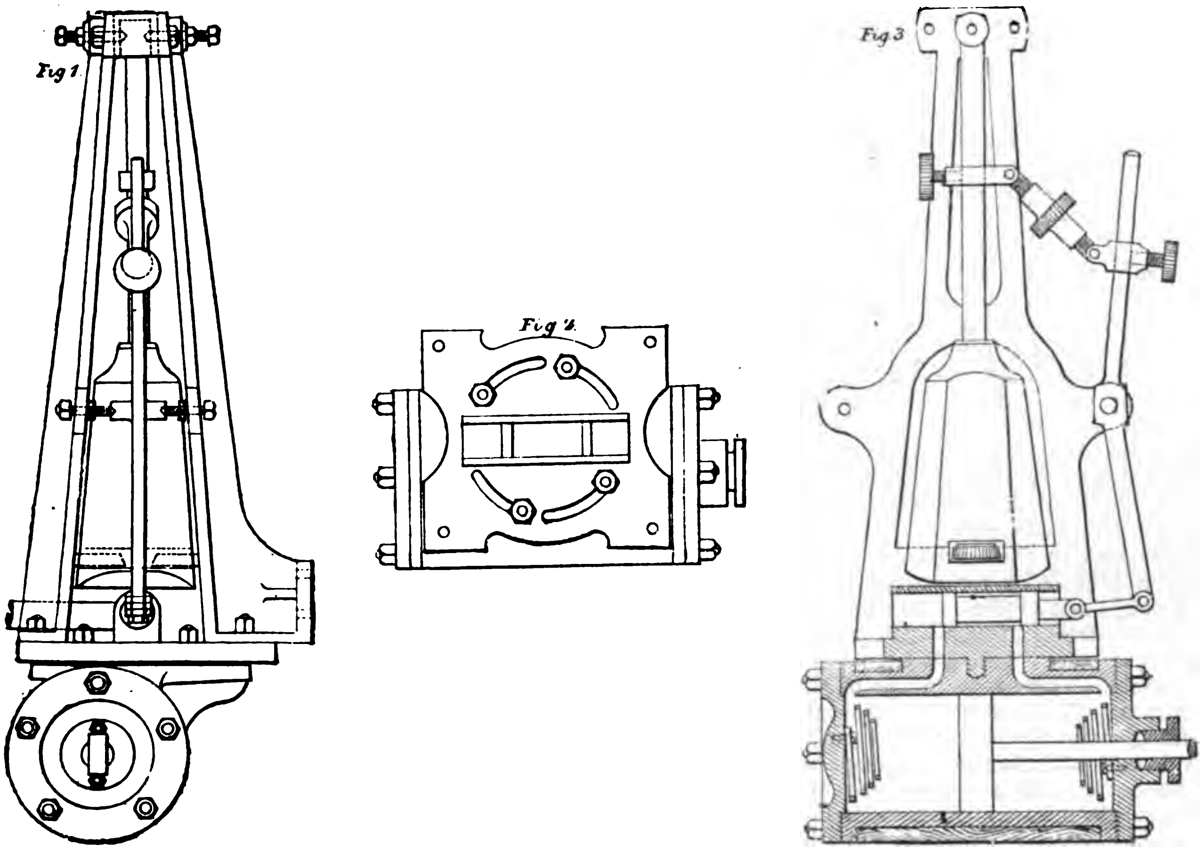
Fig. 1 is an outside elevation of the governor as it would appear bolted to the ship's side or any longitudinal bunker or partition.

Fig. 2 is a vertical section showing the arrangement of the piston cylinder and valve.

Fig. 3 is an end view of the governor, the pendulum is suspended from centres which, as it always remains vertical, moves with the pitching of the vessel. Any side movement from rolling is prevented by anti-friction rollers, sliding sleeves are adjusted by set screws to give any desired amount and speed of movement to the valve. There is a right and left handed screw to place the valve in its proper position relatively to the position of the pendulum when the vessel is on a level keel or by the head or stern. The lever that operates the valve is set on fine pointed centres to avoid rust. There is a pipe connecting the valve box to the engine condenser; the piston thus works by vacuum on one side and atmospheric pressure on the other. The valve is made of brass so that it cannot stick fast, and which opens and closes the ports to the piston cylinder. There is a bracket by which the pendulum can be attached to the side of ship or to the bunkers.

The piston is so attached to the frame that it can be swivelled in any direction to operate directly on the rod of the throttle valve.

This governor is in no experimental stage, but has been well approved in practice on upwards of 30 vessels, of which particulars may be had from Messrs. Smith & Pinkney of 57, John Street, Sunderland.



ATMOSPHERIC PENDULUM GOVERNORS.

The Patent American Cotton Belting, manufactured by Maurice Gandy, of 130, Queen Victoria Street, London, E.C., was another estimable article exhibited, which is in extensive use. It is made from the best American cotton duck, and after being saturated with a composition to prevent the atmosphere having any effect upon it, is hand woven, folded, and sewn together, and may be used as an excellent substitute for leather at only half the cost of the latter. It is guaranteed waterproof, and is not affected by the weather.

The belts are made for suitable use for any width of pulley for main driving, and if required one end can be tapered to prevent "jump" in running. These belts can be made of any length without joints, and they cling well to the pulleys. Their breaking strain is very much greater than leather according to their relative cost, as has been tested by Kirkaldy, of London. They can be used for cross-belts with reliance and safety, otherwise they would not be in operation as they now are in more than 6,000 mills and works in this country and abroad. If well known, the use of these belts would soon almost supersede leather bands for driving machinery.

The importance of having strong, durable, and thoroughly reliable hawsers, cables, and ropes has often been discussed, and for many years required before they were introduced. Some excellent samples of these articles were shown by Messrs. Bullivant & Co., of 72, Mark Lane, London. These included their patent flexible steel wire hawsers and cables, with appliance for working them in the place of chain cables, stream chain hempen hawsers and hauling warps, and likewise for use as crane ropes, purchase and cargo falls, fishing ropes, &c. We are informed that these hawsers are now exclusively used in lieu of hemp not only in the Royal Navy, but by those of foreign nations. and by nearly all the largest British and foreign steam and sailing ship owners and companies. They are far more lasting than those made from hemp, and one which was supplied eight years ago is now really as good as it was at that time. This hawser containing 90 fathoms 4½ in. was shown, and was supplied to the ship *Lady Jocelyn* (2138 tons). After being launched it was tested, and took a strain of 45 tons. Their pliability is also so good that they can easily be worked round any bit or bollard round which a hemp hawser of equal strength will work, and they can also be rove through purchase blocks for lifting heavy weights. Their weight is only one-third of that of hemp of equivalent strength, and therefore handled more easily, while they can be better coiled in a boat and payed out, and will not kink. Moreover, they are much cheaper than hemp, at first cost, and last much longer, which is a very important consideration. A sample of Messrs. Bullivant, & Co.'s Patent Flexible Steel Wire Rope, 12 in. circumference, was exhibited, which was manufactured at their works in London for the Ayr Harbour Slip Dock for hauling vessels of 1,200 tons dead weight and cradle up the slip to be worked round a drum 9½ feet diameter. The breaking strain of the rope is guaranteed to be 360 tons, and 115 lbs in weight per fathom. There is an incline of slip of one inch in 24 inches. This presents a material contrast to the breaking strain of chain of the same weight, which is only 60 tons, and a tanned hemp rope of a similar weight per fathom is 100 tons. Another sample of the kind of rope made by them, 21 inches in circumference, was also shown, and which is guaranteed to a breaking strain of 1,150 tons. It is a six strand rope and each strand contains 120 wires. This firm also exhibited, in addition to their patent floating anchors and other ship appliances, an improved automatic nipper, which has a greater grip upon the hawser as the latter increases its strain, while no portion of the nipper has to be removed for placing the hawser thereon, and the latter can with perfect safety be instantaneously released while a strain is upon it and be again gripped. The patent flexible steel wire torpedo nets shown by them, which are used by our Admiralty and most of the foreign Governments, are also very appreciable, and their exhibition may justly be said to have done them great credit.

Messrs. Siebe & Gorman, of 187, Westminster Bridge Road, London, showed some good specimens of diving appliances, both for one or two divers. Of these inventions, two appear to be well worthy of special notice, viz., their Royal Navy Pattern Diving Apparatus, with patent air pump, from which two divers can work at various depths, and submarine electric lamp appliances for communication with divers under water. As there has recently been a great extension of diving operations, these improved contrivances will probably be much required in this and other countries.

Messrs. Cochran & Co., Birkenhead, exhibit a modification of their steam launch machinery, specially adapted by them for canal steamers. From experience gained by this arrangement of machinery, now in regular work between Stockton and London in the steamers *Jason* and *Jupiter*, there is no longer any doubt but that there is a great future for canal steamers as feeders to the main lines of railway. The principal objects attained have been a gain of 15 per cent. to 20 per cent. in carrying capacity, and a very substantial saving in fuel. The engine is of the simplest possible construction, very strong in all its parts, with large wearing surfaces, all adjustable, and a linkr-eversing motion got up in the most modern locomotive fashion, and thoroughly case hardened. The boiler is Cochran's patent vertical multitubular type, with horizontal flue tubes, and is made as high as possible to pass under bridges, and is small enough in diameter to admit of sufficient side bunkers even in canal boats suitable for the ordinary contracted locks. The boiler is, moreover, perfectly accessible in every part, both inside and outside, for cleaning and examination. The illustrations show the arrangement without any detailed explanation. They also exhibit two models of steam launches, one evidently intended for high speed, and the other for rough harbour and coast service. The launches, which this firm are now making a speciality of, seem well adapted for the purposes for which they are intended, and the design and workmanship is of the highest class. A photograph of the second of two submarine torpedo boats they built three years ago is shown. It is of the cigar type, and had it not been unfortunately lost on the Welsh coast on its way round to Portsmouth Dockyard, it would doubtless have shown the possibility of carrying out the most of Jules Verne's famed "Nautilus."

The steam and hand steering patented by Mr. Holliday, which we illustrate, as made at the Bedford-street Engine Works, Sunderland, has special features of simplicity and advantage about it.

The steam power is applied by a differential action upon a piston in the cylinder to the left of the illustration, that is, the steam is admitted both sides of the piston, and the requisite movement is obtained by a reduction of the pressure on either side. It is only when the helm has to be promptly put from hard over starboard to hard over port, or *vice versa*, that the cylinder has to be fully discharged. The working is therefore very economical of steam. The piston operates direct on to the sliding cross-head, carrying a pair of grooved sheaves, to which the necessary tiller wire ropes or chains are attached. The grooved sheaves are connected with a central worm wheel which gears in an endless screw or worm over-head. So long as the worm remains stationary it acts as a rack, causing the wire pulleys to revolve as the cross-head moves with the piston, and thus to operate the rudder.

Should any failure occur in the action of the steam apparatus, the hand wheel is always in gear, through bevil wheels with the endless worm or screw. The moment the piston crosshead becomes stationary through any mishap, it can be clamped in that position, and the worm gear revolves the wire rope pulleys by the hand wheel.

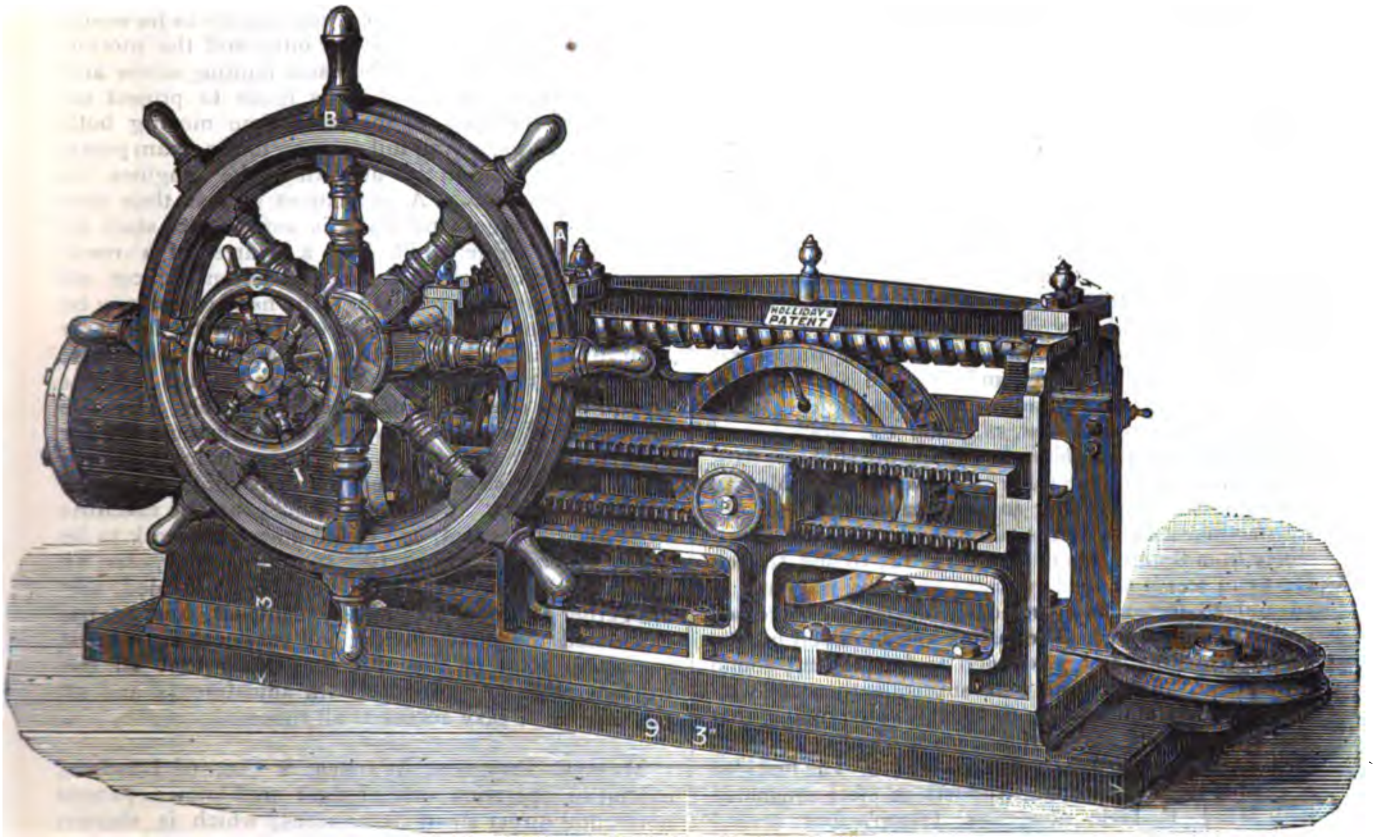
A in the diagram shows the spindle of the steam steering wheel on the bridge.

B is the hand steering wheel always ready for use. C is the stern steering wheel in the deck house.

The special features of this apparatus are its simplicity and direct action, which, dispensing with all gearing, ensures noiselessness and strength.

As there is no rotary motion from the driving cylinder there can be no dead centre, which proves often so awkward in starting engines against pressure.

The operation of the hand gear can be put in gear instantaneously in any position of the rudder, and when in gear is indirect in action through a worm so as to take all strain off heavy seas, &c.



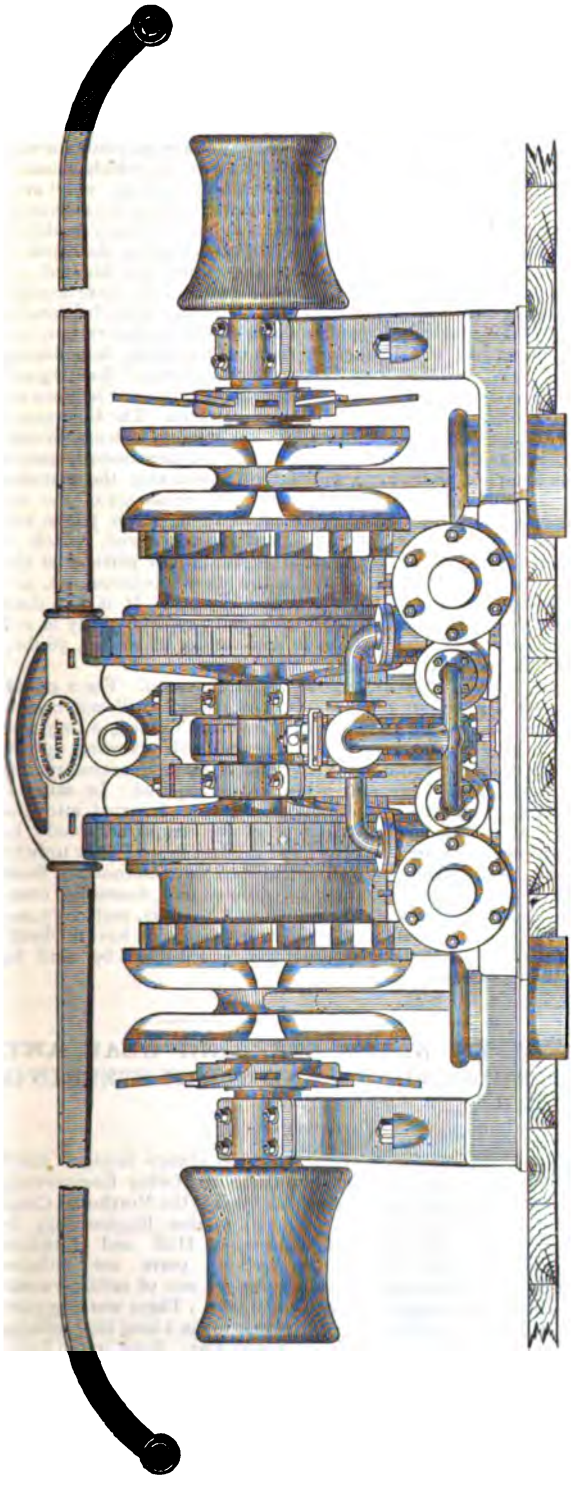
HOLLIDAY'S STEAM and HAND STEERER.

THE Leeds Forge Co., Limited, exhibit a comprehensive set of flanged plates for marine boilers, and specimens of Fox's patent corrugated furnaces and fire boxes for steam boilers, of which some 10,000 have been made within the last five years. Amongst the interesting features of this exhibit are, Mr. Fox's first corrugated flue, and specimens of flues that have been submitted to external hydraulic pressure, until collapse has taken place. Here is also shown the first apparatus constructed for testing the resistance to collapse of flues of full working size. A large number of experiments have been made with it, under the directions of the Board of Trade and Lloyd's, in order to ascertain the laws governing collapse. The advantage of the corrugations is very clearly shown by the results obtained on testing two similar sized flues, one plain and the other on Fox's patent. The collapse of the plain tube took place at a pressure of 225 pounds per square inch, while the corrugated flue stood no less than 1020 pounds before giving way. A Fox's flue cut out of a marine boiler, which became short of water at sea, is exhibited to show the highly ductile quality of the material, and also to illustrate the behaviour of such a tube under the circumstances. Besides what we have specially mentioned, the Leeds Co. show a great number of iron and steel flanged front plates for boilers, notably one 16 ft. diameter, of mild Siemens steel, for which the ingot weighed 3 tons, and numerous examples of corrugated flues and furnaces of every style, including one out of 72 flues for the "Guion" Co.'s new steamer, now building by Messrs. John Elder & Co., of Glasgow, and which, when completed, is guaranteed to cross the Atlantic at a speed of not less than 20 knots per hour.

A LARGE and instructive display of steel castings and forgings is made by Messrs W. Jessop & Co., of Sheffield, who exhibit a crucible cast steel crank shaft on Turton's patent for the ss. *Bulgarian*, an excellent piece of work, without blemish. There are also models of a number of crank shafts made by this firm, and a large crucible cast steel stern frame and rudder similar to what was exhibited at the Naval and Submarine exhibition at the Agricultural Hall. In the interval which has elapsed since then, the same stern frame and rudder have been subjected to very severe tests by the inspectors to Lloyd's register of British and Foreign shipping, and also the inspectors from the Liverpool underwriters. The stern post was elevated on end and tumbled on to a hard floor and then suspended by a chain and struck several times with heavy sledge hammers, without showing the slightest indication of a fault. The rudder was raised to a height of 8 feet and dropped on to a hard floor, then raised on end and allowed to fall so that the arc struck the ground first, so giving the stock a most severe jerk, but all without developing the slightest flaw. After these and some other still severer tests, Messrs. Jessop tested the rudder to destruction for their own satisfaction, it being dropped on the hard floor successively from the heights of 8, 10, 12, 14, 16 and 18 feet. Up to 14 feet it showed no signs of giving way, and at 16 and 18 feet, a flaw previously developed increased until fracture ensured. The casting was ultimately broken up for remelting, and was found to be perfectly sound throughout. Other tests were subsequently made with other rudders and frames, all conclusively proving that iron forgings were seldom if ever made which could stand the tests the steel castings were subjected to. The first idea of casting stern frames and rudders in steel originated with Mr. J. F. Hall, of Messrs. Jessop's firm; several small ones for yachts having been made some years ago. It was only recently, however—when a firm of consulting engineers in Liverpool improved on the idea by taking out a patent for a new method of hanging the rudder on the frame, only applicable in a casting—that the plan was brought prominently forward, and received the investigation of the committee of Lloyd's Register. Already two other firms have taken the matter up, and there appears to be little doubt that in a short time cast steel will take the place of iron forgings for such purposes, to a large extent, if not altogether.

AMONG the most recent improvements made and patented in combined hand and steam steering gears, must be noticed the gear shown by Mr. Isaac Beck, of Sheffield, at stand No. 51. It is of the well known type, having only speer wheels in its construction. The engines are of novel construction and exceedingly well placed outside the framing, close to deck, and at right angles to each other. Guide slides are formed along the sides of the cylinders, the pistons are of cast steel, forged solid, with rod, to top end of which is attached a cross head, in shape something like a stirrup, the lower ends of which slide in the guides in sides of cylinder, and also carry cast steel cross head pins, to which the connecting rod proper is attached, and so conveys the power to a crankshaft passing through centre of machine. Steam chests are fixed inside of framing, to correspond with the cylinders, in which ordinary D shaped slide valves work over the usual three ports: both valves are operated by one eccentric attached loosely to crankshaft. The engines are set in motion by the steersman turning the large hand wheel exactly as he would do if steering by manual power only, and the motion is conveyed by means of the usual hunting screw and a lever to the eccentric, which is made to project on one side or the other, at the same time moving both the slide valves, giving full opening to the steam ports, and thereby promptly actuating the engines in required direction. A movement of less than one spoke of the large hand wheel is sufficient to start or reverse the engine, while only a quarter of a revolution of the crankshaft secures an automatic cut off and stoppage when required. The hand wheel may be allowed to continue in motion until the helm is nearly hard over in either direction, when the automatic arrangement comes into action and shuts off the steam, thus rendering damage impossible. By the movement of a single lever placed conveniently for steersman, the connection may be made instantly for either hand or steam power, in any position of either rudder or engine. Used as an hand gear, the machine would be quite equal, and of full power for work to be done. Means for connecting to upper bridge, also an indicator showing position ot helm are provided, and altogether the machine is very compact, and seems calculated to prove efficient and serviceable; a most important point in this direction being that all the working parts are provided with adjustments, and all are capable of easy access at all times.

MESSRS. EMERSON, WALKER & Co., of London, exhibit in operation, one of their well-known patent horizontal direct steam windlasses, which is shown in the engraving on page 183. The machine has combined steam and hand power, the latter being arrayed with lever handles having an up and down motion. The steam cylinders are horizontal, placed very snugly inside the frames, while all the parts are easy of access. The power is transmitted from the engine staft by gearing, the motion of the cable lifters being controlled by large brass friction cones moved in and out by brass screw nuts. These cones act as powerful brakes, by which even one or two links can be given at a time, or the cables let go, veered away, or brought up. Each lifter has its own pawl distinct from the purchase, thus preventing the possibility of the cable slipping when heaving in, while it acts as an adjunct to the bow stopper when riding at anchor. The motions of starting, stopping, and reversing are effected by a single lever, by means of which the working is entirely placed under one man. The machine is exceedingly strong and well finished throughout, and all working parts are provided with a means of adjustment for taking up wear.



EMERSON, WALKER & CO.'S STEAM WINDLASS.

THE amount of damage to live stock during rough passages for want of efficient ventilation is almost too terrible to be realized. We have heard of a vessel from New York which only landed nine alive out of a cargo of 547, and in another case two out of ten succumbed to want of ventilation.

There seems, however, no reason why cattle and steerage passengers should be thus subjected to all the evils of foul air when the weather is rough, if proper ventilators are used, such as those invented by Mr. Thomas Utley, of Edge-lane, Liverpool, which will admit air under any conditions of weather and at the same time prevent the water from entering through the port-holes or hatch-ways.

This is not an experimental supposition but an accomplished fact, as a testimonial from the Captain of the s.s. *Iowa* certifies that during a rough voyage with high seas and the ship rolling 35 degrees, no water entered through the open ventilator, but plenty of air on the windward side.

The construction of the ventilator is essentially simple, being a series of self-acting valves which close with the wash or rise of the water, but so long as the port-hole or hatch-ways are free allow the air freely to pass in. They are fitted so as not to interfere with the ordinary port-holes or with hatch-ways, being fitted in the combing of the latter, so that when under ordinary circumstances of a rough sea, port-holes are closed and hatches battened down, with Utley's ventilator there is still free ingress for air but none for water. We think this arrangement is so simple that it will be generally adopted, and its exhibition at Tynemouth attracted much interest.

THE value of a good lubricant in its effect upon the life of an engine and boiler cannot be too highly praised. It is sometimes supposed that anything will do that is oily, but never was a greater mistake made. A good lubricant must have many special qualities. It must be absolutely non-corrosive and without deposit, and should readily clear or evaporate, and of course should have great body where there is much surface pressure.

Tallow, which is popularly supposed to be the best lubricant, is far from being so, as high pressure steam decomposes it into glycerine and fatty acids, which not only corrode the pistons, condensers and boilers but invariably produce excessive priming.

Engelbert's lubricator is now very generally known as one of the purest lubricants in the market, not volatile at 600 F., will not corrode, and leaves absolutely no deposit. Its body is also so great that it effects an economy of 30 per cent. compared with the best tallow

Mr. Beynon. the enterprising Newcastle agent for this lubricant, reports that by invitation he was present at the examination of the engine and boiler of a Newcastle steamer, running five years with Engelbert's lubricator. The engineer found the condition of engines, boiler, and condenser, perfect, and came to the conclusion the boilers and machinery would run another five years with little done to them. There was a marked absence of any pitting in the boiler.

Such instances of satisfaction with the Engelbert's lubricator seem very numerous, and so long as the present quality of the lubricant is maintained there is little doubt that Messrs. Engelbert & Co. will do a constantly increasing trade.

MESSRS. SAMPLE & WARD, of Low Quay, Blyth, Northumberland, exhibited an improved automatic detaching gear for Ships' Boats, which are likely to be very beneficial by saving men's lives at sea. By the use of this appliance, many dreadful accidents which often occur during the lowering of boats at sea, is entirely avoided, as one hook cannot detach without the other, but the instant the boat is water-borne (in any position) both hooks are detached at the same time, while if one tackle is tight and the other slack, both hooks remain fast. There are fixed upon the keelson at each end of the boat, two brass cranks connected by a small longitudinal rod, and there are two vertical rods from the extremity of the cranks, the upper ends of which are connected with the detaching loops. A weight fixed on the stem vertical rod canoes the detaching power. As soon as both tackles are relieved of their load, the weight falls, taking both hoops from the main hooks simultaneously. The tackle falls can either be fitted with ordinary hooks or with rings, and as no overhauling of the tackle is necessary, the boat can be safely lowered while the steamer is going at full speed. This automatic detaching gear is readily adaptable to any sea-going boat, without either interfering with storage room or with the comfort of the occupants. From its simple construction it is impossible for any part of the appliance to get out of order or failing in its action, and as it is cased in along the Keelson, no portion of it is visible except the two hooks, and no instructions are required, as the ordinary tackle-fall hook is connected in the usual manner. It is also very cheap, efficient, and self-acting. The patentees justly say that "after many severe tests at all times and in all weathers, nothing has been found to deprive the Automatic Detaching Gear of its reputed merits, or of its well earned reputation of being an invaluable means of saving life at sea at times when the loss of a minute means the loss of one or more precious lives." The advantages of this appliance have been well acknowledged by the Board of Trade and a great number of shipowners, who have used it for many of their steamers. It is to be hoped that this additional means of preserving life will be duly recognized to the extent it deserves, as it is one of the most important patent ship appliances that has been invented.

MR. R. H. TWEDDELL, of Westminster, exhibits in operation a complete series of his hydraulic rivetting plant, suitable for ship builders, and in order to show the machines as nearly as possible under working conditions, Messrs. Andrew Leslie & Co., of Hebburn, have sent a portion of a ship's keel with garboard, strake, and floors. A set of force pumps, driven by a belt, supplies water to an accumulator loaded to 1,500 lbs. per square inch, and enables a keel rivetting machine and a portable rivetter, having a gap of 4 feet 6 inches, to be shown at work closing rivets. There is also a hydraulic crane, from which the portable rivetter is suspended, and the flexible copper pipes with special joints used for transmitting the water under pressure.

PATENT JOINTING COMPOUND.

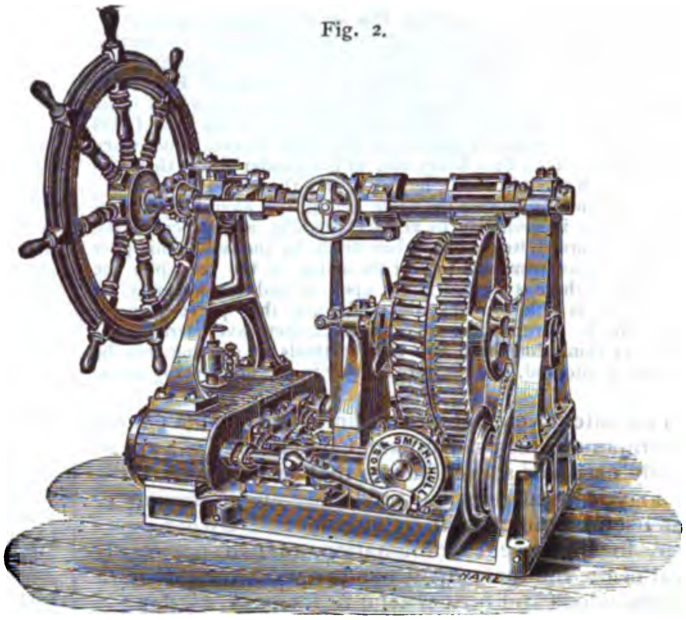
WE need scarcely say that it is quite self-evident that an article capable of at once making the joints in pipes, cylinders, condensors, and other parts of mechancial appliances steam, gas, water, or air tight is so appreciable as to need no comment. It is also equally clear that the cheaper this compound is the more it is likely to be used. Now the articles generally supplied for these purposes before the introduction of the Patent Jointing Compound was white and red lead, and we quite agree with the *British Trade Journal* that the difficulties connected with the application of those substances are numerous. Among others, they are not always ready for use, and often break or peel away, while the particles which emanate from them will probably cause considerable damage and "even more trouble in the working parts of an engine." They are, moreover, dangerous poisons, and cannot be relied upon, and much trouble is occasioned in removing them and properly cleaning their joints. The Patent Jointing and Manufacturing Company, Limited, 17, Charterhouse Buildings, Goswell Road, London, E.C., have brought out a patented composition, which not only supplies these deficiencies but fully suits the requirements of mechanical engineers, gas, and water fitters. It is much cheaper than red and white lead, taking bulk for bulk, and, therefore, 7lbs of this "Reliance" Jointing will go as far as 21lbs of lead. It may for many purposes be used instead of india rubber rings and leather workers. The Compound is always ready for use and requires no mixing, cutting, fitting, or softening, and when once applied will last permanently unless broken purposely, when it will be perceived that the metallic surfaces joined are very easily cleared of all remnants of the old jointing. It can be applied without waste in screw joints, and never so fixes a joint that it cannot be unscrewed, which is frequently the case when red lead is used. No particle of the patent compound need be wasted as the other substances are, and no packing, hemp, or gaskin is required for such. It is of a dark brown colour, of the consistence of a well prepared putty or red lead, and is conveniently packed in iron drums, of 28 lbs., 56 lbs., and 112 lbs., ready for use.

The compound may be applied in various ways. For a 4-inch flange joint, 4 ounces of the substance, which will not cost a penny, may be used by rolling it into a cord and forming a ring and then placing the ring inside the bolts and well screwing up the joint. For screwed joints the compound may, if necessary, be thinned with boiled oil, and hemp is not required. In using it for socket joints the spigot should first be inserted into the socket, and then a sufficient amount of the compound should be taken, pressed well into its place, and caulked in with yarn tightly. Its merit and quality is well established by testimonials from British and Foreign Governments, railway and steamship companies, gas and water works, coal and iron masters, managers and engineers, and employers of machinery generally, we have no doubt that for the purposes for which it is intended it will be used far more than any other compound.

AUTOMATIC STEAM STEERING GEAR, AND COMBINED HAND AND STEAM STEERING GEAR.

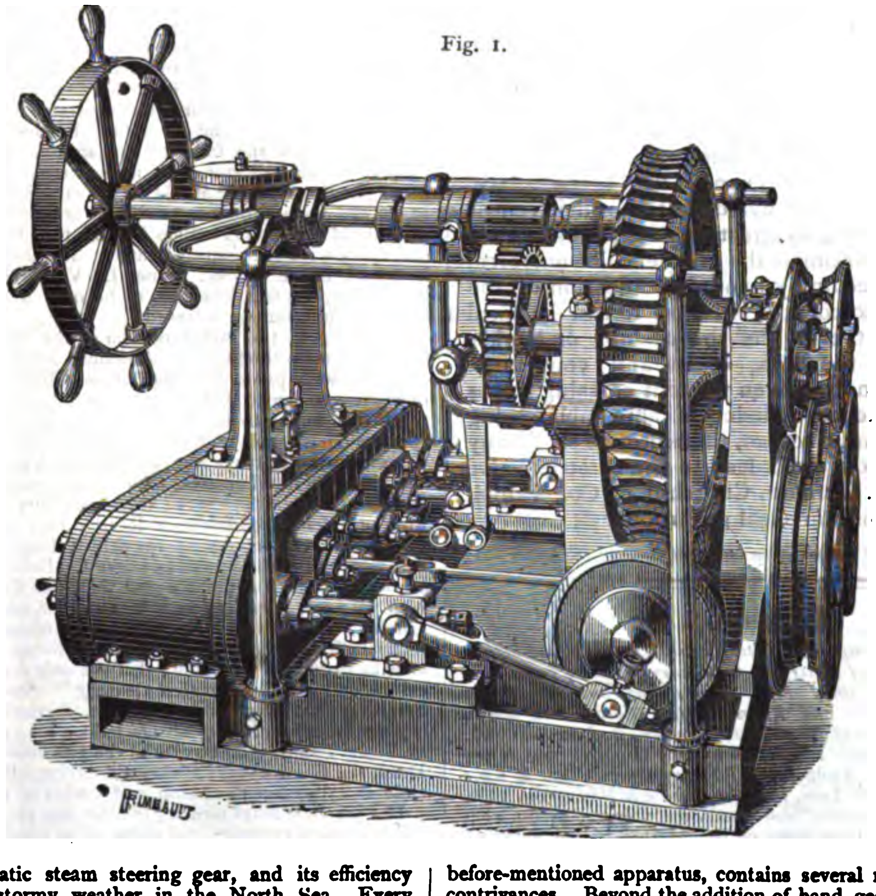
THE mechanism for steering ships has always engaged much attention as an important appliance of Marine Engineering. Two systems for this purpose were exhibited at the North-east Coast Exhibition of Naval Architecture and Marine Engineering, by Messrs. Amos & Smith, Engineers, of Hull and London. In the illustration, Fig. 1, the working parts are reduced as much as possible, and its liability to get out of order is much reduced by the slow speed at which it works. These working parts are of large surface, which enables the gear to run a long time without re-adjustment. In its operation it is noiseless; there are no levers for the steersman to work, and the steering wheel is easily manipulated, and in all other respects is in a similar manner to the wheel of an ordinary hand-steering gear, so that it can easily be worked by any qualified seaman without special training. The starting, stopping, and reversing operations of this apparatus are performed by a controlling valve, which is fixed between the valve boxes of the two cylinders, and by the change of the position of the valve it can admit the steam on either the steam or exhaust sides of the valves, between which it is placed. When at the middle point of its traverse, this valve closes all steam and exhaust passages, and, therefore, effectually stops the engine. The

Fig. 2.



AMOS & SMITH'S STEAM, AND COMBINED HAND AND STEAM STEERING GEAR.

Fig. 1.



controlling valve is connected through the medium of a differential gear, both with the steering wheel as well as the engine, so that any motion of the former which tends to open the valve is followed by a motion of the engine on account of such opening and admission of steam. The valve returns to its centre upon the engine moving, thereby the direction and quantity of the motion is imitated by the engine, the consequence of which is that there is an entire automatic following of the steersman by the engine. Upon its main principles, the general amount of the movement would be applicable to numerous gears which were shown, but the mathematical exactitude with which it is done, is an important point in the gear of Messrs. Amos & Smith, as it was noticed that the movement of a quarter of a spoke was accurately repeated, while the shaking of the steering wheel caused a forward and backward motion of the engine to a fractional part of a stroke. It is also observed that in other ways both the engine and gear seem to be well suited for the purpose for which they are constructed. Upon placing a gear on board a strange vessel, notwithstanding there may be a variation of the pull of the chain within wide limits, both the direction which the rudder has taken, and its actual angular position may be read in the index. The gear can either be used off one or more decks or from a flying bridge, when the index will register it on the bridge and also at the gear. The index remains in action when the bridge gear is not connected, therefore the master or pilot can instantaneously alter the course which the ship is then taking. Many appreciable testimonials have been given in favour of the working of this improved automatic steam steering gear, and its efficiency is highly praised in stormy weather in the North Sea. Every machine is excellently finished and duly tested under steam before leaving the works.

Fig. 2.—Messrs. Amos & Smith also exhibited their Combined Hand and Steam Steering Gear, which they recently invented, and which, though not materially different in appearance from the before-mentioned apparatus, contains several new and important contrivances. Beyond the addition of hand gear this modification has been effected to satisfy the requirements of many shipowners. Small brass wheels were used in the Steam Steering Gear to actuate the differential motion driving the controlling valve. In the new apparatus, these wheels are replaced by a cast iron wheel and pinion, strong enough to steer the ship as a hand gear, and can,

as desired, be made to perform this or the former purpose by merely throwing a crutch in or out, and simultaneously connecting or disconnecting the engine by friction coupling. This manipulation is very quickly done, and the machine at the Tynemouth Exhibition was frequently changed between hand and steam in less than three seconds. Very important results are produced by the use of this friction clutch between the engine and the chain sheeve. Thus, when the rudder is struck by a heavy sea, with a greater force than the friction clutch can withstand, it yields, and the strain is relieved; but as such motion is from the valve action, the engine is started by the latter immediately to replace the slip, and so cause the rudder to return to its position when struck by the sea. This gear also enables the helmsman to feel the action of the sea upon the rudder when there is a great strain upon it, and, consequently, by yielding, he is able to relieve the strain, and thus prevent an injurious shock. From the manner in which they have been appreciated, we think that these two new methods of steering will be extensively adopted, and they are already in use upon many ships.

THE patent velometers and universal marine engine governors of Messrs. Durham, Churchill & Co., are so widely used and so well known that perhaps some little apology is needed for our producing an engraving of this useful adjunct to an engine-room. Owing, however, to the recent combination of two previously rival firms, the instrument has received some modifications which still further tend to increase its general adaptability. These improvements are clearly shown in the engraving on page 187. In a little more than four years, upwards of 1,100 steamers have been fitted with velometers and universal governors, and at the present time no less than 300 of them are in order, facts which sufficiently testify to their excellence. It is only of recent years that the use of governors of any kind have become general on board steam vessels, it is no doubt mainly due to the invention of Mr. Durham that this change has taken place. Racing is now practically avoided, the sensitiveness of the velometer being so great that it almost seems to anticipate the working of the engine. The universal governor is an exceedingly handy modification of the velometer, and is so constructed that it can be fixed without bracket, either to the thwartships or bunker bulkheads, under the deck, or in any convenient position, and it can be driven without crossing ropes or belts. The steam cylinder is adjustable, being carried on trunnions, and can, therefore, be set at any angle to get the most direct lead to the throttle valve spindle. Messrs. Durham, Churchill & Co., exhibit both velometers and universal governors.

(To be completed in our next issue.)

Reviews.

The Practical Steam Engineer's Guide, in the Design, Construction, and Management of American Stationary, Portable, and Steam Fire Engines, Steam Pumps, Boilers, Injectors, Governors, Indicators, Pistons, and Rings, Safety Valves and Steam Gauges, for the use of Engineers, Firemen, and Steam Users. By Emory Edwards. Illustrated by One Hundred and Nineteen Engravings. Philadelphia: Henry Carey Baird & Co.; London: Sampson, Low, Marston, Searle & Rivington. 1882.

The contents of this portly and handsome volume, by the well-known author of the "Catechism of the Marine Steam Engine," &c., do not belie its title page. Mr. Edwards sets out, as he indicates in his preface, with a three-fold object. He desires to give intelligent and intelligible information to the men, often of very limited education, who *run* steam engines on every branch of their daily work; he also purposes to "place within the reach of mill-owners, superintendents, and other bosses . . . . . . the means by which they can intelligently supervise the steam as well as other departments under their charge"; he endeavours also to guide the intending purchaser of engines and boilers in his choice. These objects are well attained in the various sections of this volume, which we shall endeavour briefly to review in the hope that our readers may be thereby induced to proceed further and study the book itself.

The opening paragraph is so characteristic of the spirit in which our author addresses himself to his task, and withal so neatly put, as to deserve quotation. "The very first qualification," he says, for an engineer, "is *sobriety*. No man who drinks intoxicating liquors to excess is fit to be an engineer, fireman, or in fact anything else about a steam-engine; and the law should be so amended as to prohibit, under the severest penalties, the employment of such men. He need not necessarily be a machinist by trade, but he should be a man of mechanical ideas. Practical steam engineering consists in the tact of the engineer in discovering faults in the working of his engine and in applying the proper remedy. A man might be a good machinist but a poor engineer, from want of tact." Continuing the introduction, we find by way of question and answer a lucid and simple explanation of the philosophy and operation of the steam-engine, not containing any thing very new perhaps, but then the theme is one whereon novelty is barely possible. We should recommend the student who is tolerably fresh to the subject to read after the introduction, chapters vii., xiii. inclusive; he will be thereby better able to appreciate the elaborate descriptions of completed machines which precede them. Here will be found an admirable chapter on the Injector, explaining fully its theory and the principles whereon the admission and admixture of steam and water are based. The, to many, paradoxical relations between the supply and the temperature of the feed water are also most philosophically expounded, and some half-dozen of the modern and most perfect American Injectors and Inspirators are described and illustrated with admirable sectional and other drawings. This remark, by the way, applies to all the subjects treated, and we may add as a tribute to the binder that the numerous double-page plates are mounted in guards and thus preserved from a too common defacement. The Governor follows, and all who, like Mr. Edwards, hanker after elemental simplicity, will admire "The Chase," wherein steam packed valve-stems are discarded and the governor valves so arranged that they themselves revolve about an axis and are actuated immediately by the centrifugal force and the force of the spring. No one reading the chapter on the Indicator, with its numerous illustrative diagrams, in conjunction with the article on the same subject which appeared in our last issue, should be unable accurately to take and to *read* a diagram of any engine. Slide Valves, the Piston and its Rings, and Gauges are successively treated. The chapter on Safety Valves is stated to be by W. Barnet Le Van, and is disappointingly incomplete, in fact it seems to be only a portion of a longer treatise injudiciously condensed.

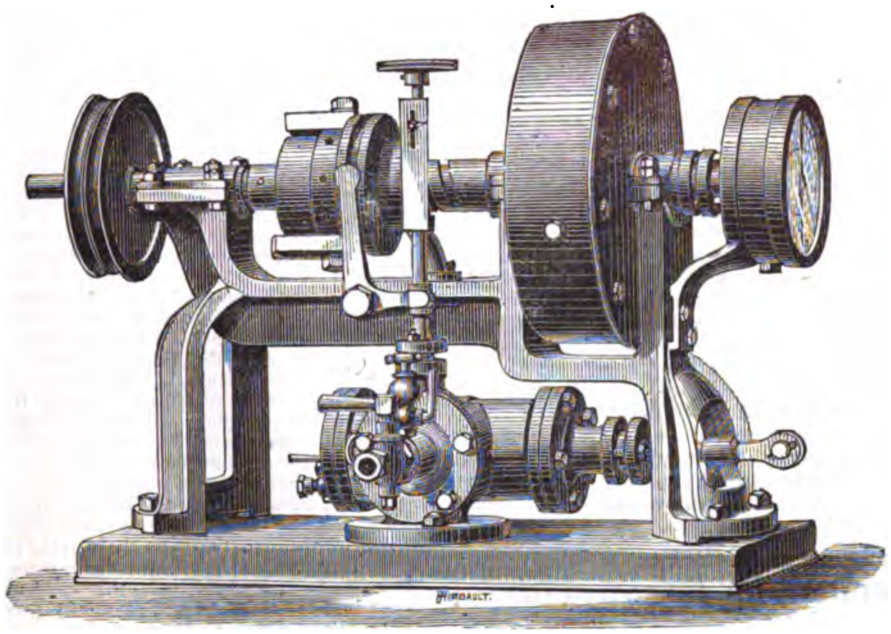
Reverting to the earlier portion of the work, the first chapter introduces us to the Standard American Stationary Engines. Except that with pardonable patriotism, Oliver Evans is set up in opposition to James Watt, no space is wasted on obsolete types, or types that ought to be obsolete. The modern shortstroke, high speed models, such as the Allen, the Corliss, the Greene, the Wheelock, the Buckeye, the Watertown, &c., are alone described and carefully discriminated. The points wherein they are alike, and those wherein they vary; their suitability for various classes of work or different conditions of location, are impartially given, and will be read with interest by the skilled English engineer, and we may add with profit as well as interest. Boilers next demand attention, and much admirable and judicious discussion will be met with on such points as fuel, combustion, efficiency, incrustation, priming, and testing. The effect, very often the extremely prejudicial effect, of the most popular *anti-incrustators* is investigated, and the deduction arrived at: "that the only certain cure is periodical inspection and mechanical cleaning." Standard Portable and Semi-Portable Engines and Boilers, Agricultural Engines, Fire-engines follow, with last, but not least, a long and valuable chapter on Steam Pumps. The Davidson, the Isochronal, the Cameron, the Dean, the Knowles, the Blake, and others, all here find their place amid an exhaustive discussion, and a mass of useful information.

The practical notes forming the last fifty pages should be in the hands of every engineer, and above all of every fireman and stoker. Mr. Edwards is vivaciously severe upon "cheap John" firemen, and not less so on their employers, who, wisely saving the penny in wages, lose the pound in fuel.

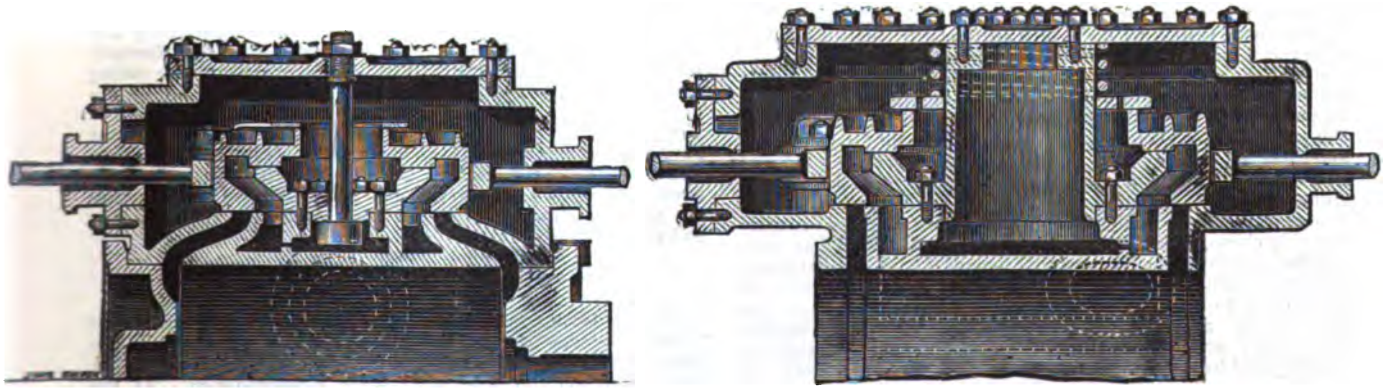
Our readers will thus have some idea of the scope and value of the subject-matter of this volume, and we have already indicated our opinion that the manner is worthy of the matter. It is anything but dry reading; there is verve and occasional humour throughout; the style is that of a man who thoroughly knows and dearly loves his subject.

Reed's Tables of Distances between Ports in all parts of the World, and other useful Tables. **Sunderland. Printed by and for Thos. Reed & Co., 184, High Street, West London: Simpkin Marshall & Co., &c. Liverpool, Phillips & Son.**

The above is an extremely interesting and also a very useful pamphlet, and contains a large amount of very systematically compiled information. After giving the distances in the North Sea and the English and St. George's Channels and the coasting passages, the distances are mentioned between certain leading British ports and those of foreign countries. In the Red Sea, India, China, and Japan table, and the Atlantic, West Indies, Brazils, Cape of Good Hope, East and West Coast South America, Australia, &c., table, two distances are given, the former of which is *via* the Suez Canal. This information is followed by a table for converting knots into miles, a time and knot table, a list of corresponding readings of Fahrenheit's, Reamur's, and the Centigrade Thermometrical Scales, a useful Catalogue of Charts, Pilots and Books of Navigation on the Marine Steam Engine and Nautical Instruments sold by Thomas Reed & Co. We have no hesitation in saying that both naval men and ship passengers will be much pleased with the information contained in this *brochure*.



Messrs. DURHAM, CHURCHILL & Co.'s PATENT VELOMETER.
(For description see page 186.)



Messrs. WALTER C. CHURCH & Co.'s. PATENT CIRCULAR BALANCE SLIDE VALVES.
(For description see page 176.)

A NEW SYSTEMATIC COLLECTION OF CATALOGUES, PRICE LISTS, CIRCULARS, &c., FURNISHED AT THE NAVAL AND SUBMARINE EXHIBITION IN APRIL LAST.

As there is such an immense number of different articles and machines in use for naval, marine and submarine purposes, it is highly essential that the most efficient and economical of them should be easily ascertained. This required advantage, however, is one which we have not possessed until very recently, and the consequence has been that many excellent patented inventions for use at sea and on ships have not been duly estimated or supplied to anything like the extent they otherwise would have been. It is, therefore, with much gratification that we have been informed that Mr. Sampson Barnett, the organizer of the Exhibition, has just completed a series of collections of catalogues, price lists, circulars, drawings, photographs, &c., obtained from the numerous exhibitors. These sets, which are well bound in thirteen volumes, are each accompanied by a manuscript index, containing the names of the exhibitors, and the appliances and machines shown by them. It is proposed to present a series of these to the Admiralty and the Naval Departments of the principal governments possessed of ships of war. The benefit of this course will no doubt be very great to manufacturers, as these departments will select more suitable articles than they have hitherto done. The idea of this important collection, we are told, originated with a request by our Admiralty to send any of the printed matter contained in the constituent parts of the collection to their govermental department. It reflects much credit upon Mr. Barnett, for having accomplished this most estimable task in a much better manner than was expected, and for supplying foreign governments with an account of methodically classified information upon the subjects referred to, which cannot fail to be productive of much good as well as of much additional advantage to the exhibitors.

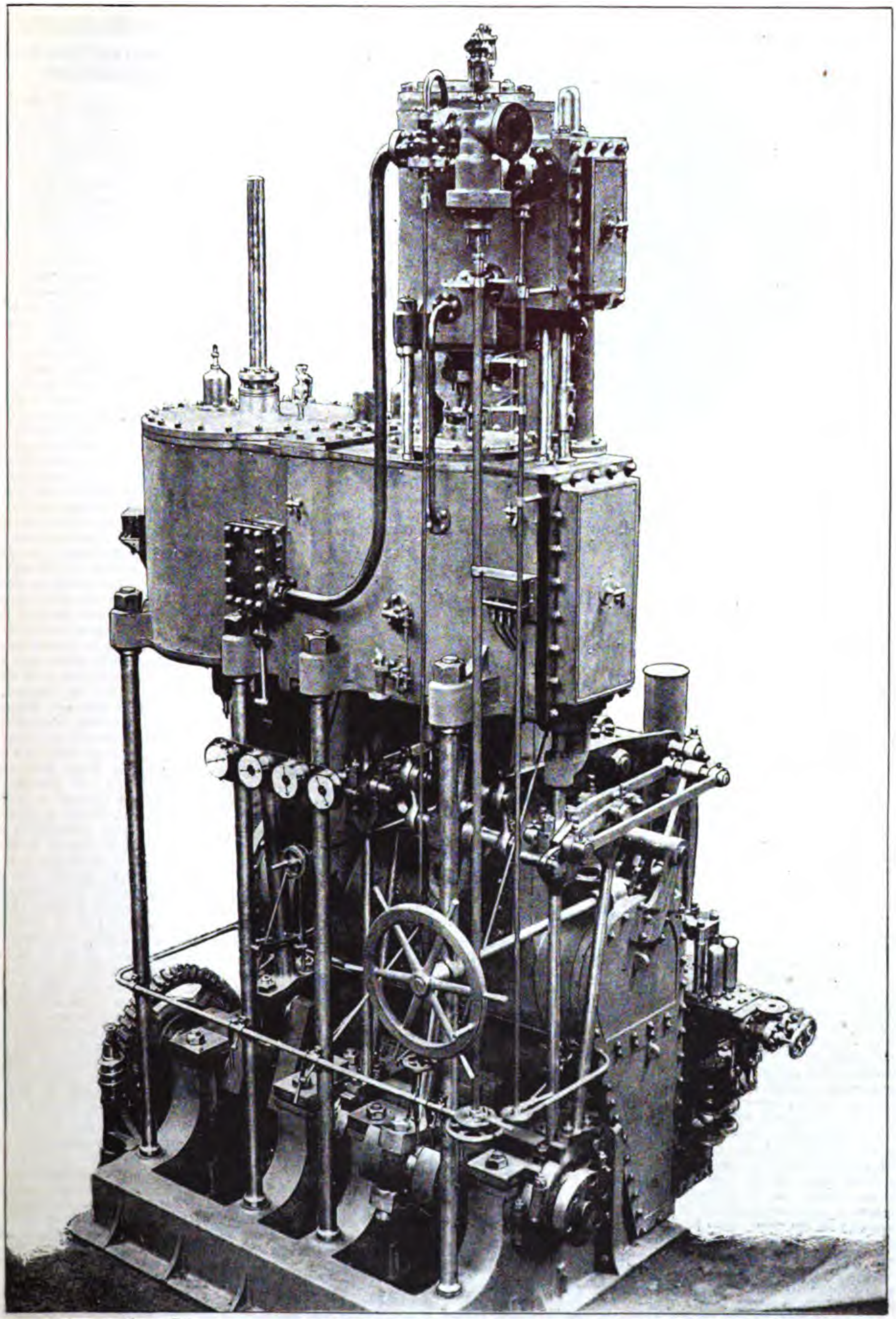
SHIPBUILDING AND SHIPOWNING.

In the past two years the growth of the mercantile navy of Great Britain has been more rapid than in any previous period, and at the present time shipbuilding at all its great centres is more active than it has been previously known to be. That growth and that activity are such that many interested in the industries are beginning to doubt whether their prolonged endurance is possible; and whether there can be long found a profitable use for the vessels that are so rapidly being added to our large fleets. Last year the gross tonnage of British merchant steamers alone was 5,757,543 tons, and while the number and the tonnage of merchant sailing vessels is declining, it is more than counter balanced by the increase of the fleet of steam vessels which is now continuously going on. And from the returns that are monthly given for the Clyde, and estimates of the vessels built in other shipbuilding ports, it seems probable that the present rate of construction of iron vessels—chiefly steamers—is to the extent of about one million tons of merchant shipping yearly. There is a small part of this built for foreigners, and there is a larger portion that is built to replace the wood and iron vessels that are annually lost; but allowing for these, there is still a very large addition to the fleet of the merchant vessels of the United Kingdom. And with iron and steel and other materials tolerably cheap, it is not to be wondered at that there has been that large investment; but now that some of the freights have been reduced so much, the wisdom of continued investment seems a little open to doubt. Each steamer is usually said to be three times as effective as a sailing vessel of similar dimensions, and thus the addition to the tonnage is accompanied by a still greater increase in the carrying capacity of the fleet as a whole; and although no statistics are available on this point, yet there seems some ground for the belief that the increase in the carrying capacity is above that of the increase in the trade over sea to be carried. And although there has been taken up a very large amount of tonnage for the transport service—much larger than that set free by the collapse of some branches of trade in Egypt—yet freights seem to have known no real improvement generally; although some homeward rates are better, the outward rates are in general low. And with the placing of a large part of the transport fleet in the market, and the continued launching of new vessels, it is to be expected that the rates of freight will fall rather than rise, and so the prospects before the shipping trade do not promise very bright. What ultimately determine the amount of new vessels built are the cost of the material and the remuneration that the completed vessels will earn. At the present time, cheap iron and steel stimulate construction, more especially when there is a belief that higher prices are probable; but against this is to be set the very rapid increase that has taken place in the price of the labour employed in shipbuilding. Last year at many of the shipbuilding centres there was an increase in the wages of most of the workmen to the amount of 5 per cent., but since then small sectional advances have taken place, and now the increase is much above that, while the irregularity of the working of some of the workmen has made construction more costly to the builders than it ought to have been. The fulness of the demand for vessels, and the large number of the contracts that have been placed, rendered it imperative on the builders to pay the amounts asked; but although there is generally work in hand that will occupy some months, it is certain that much of that demand is being gratified, and that in the near future lower remuneration for vessels will check its fulness. Meantime, the great activity of the shipbuilders is stimulating the trades of their districts, and is in a very marked degree contributing to that revival of commerce on which depends fuller enjoyment for the merchant marine.

Another of the conditions of the shipowning industry which is looked upon with some anxiety is the large amount of capital that is being invested by small capitalists. Steamship owning has been very profitable, and many have realized returns compared to which railway and other investments give a trifling percentage only. Managing owners, taking advantage of this, and of the law that allows a vessel to be owned by a large number of owners of the 64 parts into which its ownership is legally divisible, have induced capitalists to buy single shares in amounts ranging from £250 to four times that sum. The managing owner receives a considerable remuneration —often a percentage on the gross profits—for the management of the vessel; the accounts furnished to his co-owners are of the most skeleton character; and it is the exception to find any reserve laid aside for purposes of renewals or heavy repairs. Under these circumstances new vessels yield necessarily large dividends; but those who know the depreciation in the earning power of steamers, the need for renewals in less than a dozen years, and the heaviness of insurance in such cases, look with some uneasiness to the time when many of these vessels owned by private partnerships will prove almost unremunerative, and also practically unsaleable. Should the ownership of the shares be then in the hands of persons who cannot respond to calls, there may be a very rapid confiscation of capital that would certainly change the flow of it into shipping from small capitalists, and so might give the needed check to shipbuilding, if it had not come about from other causes. There has also been remarked a rapid increase in the average size of the vessels built—an increase from less than 1,000 tons per vessel on the average of those built in the year 1879 to more than 1,500 tons on the average last year. This growth of the average is largely contributed to by the large number of vessels built for the American and other trades for the great companies. The comparatively few sailing vessels built is another cause of the large average, because steam vessels are rarely built so small as were many of the sailing vessels. A demand may arise for small steam vessels to take the place in some trades of the fast-decaying small ships, but there is likely to be a declension in the demand for the large vessels that have of late given activity to so many yards. All these considerations, then, make the future of shipping a matter of some anxiety, because of its own importance, and also because of the effect on the great construction industry of the seaports of the north-east and of the Clyde.

Messrs. Hodgson & Soulsby, of Blyth, have five new vessels in various stages of construction, and one new screw steamer, the *Karaweera* fitting out, and Mr. R. Lough has two wooden hoppers building for the River Tyne Commissioners. At the Scotswood Iron Shipbuilding-yard, in the upper reaches of the Tyne, there is a new vessel undergoing finishing operations in front of the works, and three new vessels are on the stocks.

At South Shields business is still brisk. Orders are on hand at the large engine works, which will keep the men well employed until the spring of next year.



"Ink-Photo" Sprague & Co London E

COMPOUND MARINE ENGINES OF THE S S. ALBERTINA.

(For description see Trial Trip.)

LUMINOUS PAINT FOR NAVIGATING, SUB-MARINE, AND SHIP PURPOSES.

AMONG the more useful and beneficial inventions which have recently been patented, Balmain's Luminous Paint is unquestionably one of the best, and is calculated to produce numerous appreciable results, many of which have been satisfactorily realized. Mr. Balmain, the inventor of this compound, was an eminent scientific chemist, and for a long time Managing Director of the important and well-known Greenbank Alkali Works in Lancashire. An interesting memoir of his life was read before the Chemical Society's Anniversary Meeting on the 30th of March, 1880.

As he died shortly after he obtained his Letters Patent for the manufacture of this paint, he had not completed the experiments he was making concerning it, but these were proceeded with, and completed by Messrs. Ihlee & Horne, of 31, Aldermanbury, London, who now hold the patent and have successfully applied it for a great variety of purposes.

To those persons who might be disposed to question the novelty of this invention on the ground that Canton's well-known phosphorescence, which has existed for more than two hundred years, acted in a similar manner; we answer that his phosphorus never came into use, as its emitted light only lasted but a few minutes, while Balmain's paint remains luminous for hours, and hence he is the first to produce a practically useful illuminating compound, for perception in the dark applied to surfaces of substances.

Several very favourable notices of this new paint have been published in our technical and general newspapers and periodicals, but none of them give anything like a full description of its merits, either generally or as regards its marine or sub-marine purposes, or its use for ships. Nor does this deficiency appear to be supplied by any other publication or publications. In justice, however, to Professor C. W. Heaton, F.C.S., who has given by far the best account published of this patent compound, in his lecture before a meeting of the Society of Arts on the 11th of March, 1880, and which gained the Society's Silver Medal, we have reason to believe that he would have notified its merits far more extensively had time permitted of a longer paper being read before the meeting. Since that period several important new facts and scientific observations have been communicated respecting this paint. We therefore propose to furnish for the first time what we believe may reasonably be called a full logical description of this invention from the published information before us, so far as this invention is applicable for use upon, and under the surface of the sea, and for steam and other ships.

This paint which contains no phosphorus and is only produced in two shades, viz., a yellowish white and ultramarine blue, is very sensitive to ordinary daylight and artificial light, and after having been laid on any substance with a brush and then exposed to the action of light the molecules of the paint are smartly struck by the rays which causes them to vibrate and emit waves of light. A very short exposure of the paint produces the highest degree of luminosity, though the amount of this necessarily depends upon the quantity and quality of the light to which it is exposed. As the light emitted from the paint is not caused by combustion, the atmosphere is not vitiated by it. The luminosity of this new paint upon the surface of an apparatus is not diminished by exposure to, or being submerged in cold water, therefore a painted life-buoy or diver's dress with Balmain's patent compound, will retain its brightness under the surface of the water.

The luminosity of a surface coated with Balmain's new paint is not merely dependent upon the quantity and quality of the light to which it is exposed, but also upon the quantity of the paint covering it, and it is beyond doubt that any article to which this paint is applied will be visible all night after exposure to light "and the darker the night, the better it will be seen." According to the price list of Messrs. Ihlee & Horne, satisfactory results of Balmain's patent luminous paint can only be obtained by applying three coats of it in its oil form "upon an undercoating of neutral base or iron paint, according to the nature of the article. . . . Under ordinary conditions, the oil paint withstands the action of wind and weather, but when it is exposed to extreme friction, as for instance on sea buoys . . varnish is requisite." Balmain's novel luminous compound is also as durable as any other paint, and continues phosphorescent as long as it is clean and uninjured.

With regard to the durability of the paint, this is likely under fair conditions to retain its luminous property from eight to eighteen months, or for many years if protected by glass. The oil appears to protect it very much, both from bad weather and water.

By far the most important use to which this novel luminous paint may be applied is for coating surfaces for navigating submarine and ship uses. Thus it is highly important that channel-buoys, mooring-buoys, wreck-buoys, life-buoys, sandbank-buoys, herring-fish-net-bouys should be painted with this new compound. Very great difficulty and danger is frequently experienced upon dark nights in observing the buoys, whereby ships are occasionally stranded and wrongly steered in and out of channels and the mouths of rivers. (*To be continued.*)

THE POLYPHEMUS.—The armour-plated torpedo ram *Polyphemus*, Commander May, got up steam at Chatham on September 21st, and in the afternoon left, on her way to Portsmouth. Her engines worked very smoothly, but it is expected her boilers will give some trouble, and although they were made to work up to 120 lb. per square inch, an inspection has shown that it would not be safe to work them over 70 lb., and an order has been issued that on the passage round they are not to be worked beyond that pressure. The result of the journey to Portsmouth will pretty well determine what will be done with the vessel, but it is fully expected that her boilers will have to be taken out and replaced by others. They are of the locomotive pattern, and were put on board more for experimental purposes than anything else, as they do not occupy as much room as ordinarily; but up to the present the trials which have taken place with them have been failures. It is understood at Chatham that she will not go beyond Portsmouth, as it is believed it would not be safe to send her to sea.

THE SOCIETY OF ENGINEERS.—The Society of Engineers paid a visit of inspection yesterday to Portsmouth, and by special permission of the Admiralty the members were allowed to inspect all parts of the dockyard and the ships in harbour. The party numbered 120. They proceeded from Victoria Station by special saloon train which reached its destination shortly after 11 o'clock. The company included the President (Mr. Jabez Church); the Vice-President (Mr. William Schonheyder); Messrs. R. Berridge, C. Gandin, and A. T. Walmsley, members of the Council; Messrs. J. Bernays, T. Pendred, and R. Spice, Vice Presidents; Mr. A. Williams, Hon. Secretary and Treasurer; and Mr. Bartholomew Reed, Treasurer. Upon their arrival the visitors proceeded by tramway to Cawte's Hotel at Southsea, where they partook of luncheon. The practical business of the day was then commenced. The party was divided into sections, each taking independent routes over the dockyard. The section accompanied by the President were conveyed by steam launch to her Majesty's ship *Vernon*, the torpedo training school. They were received by the captain and escorted to the senior class-room in the tender *Ariadne*, where Lieutenant Batten explained the methods of torpedo warfare, and illustrated by a series of experiments the use of mechanical, and contact, and electrical wires, and also the advantages of counter-mines. He reminded his hearers that mines were only employed for defensive action, torpedoes being requisitioned for offensive purposes, and observed that a counter-mine of 500lb of gun cotton was estimated to clear a space of 90 feet. The electrical steering of a countermining launch was also exemplified, and the visitors subsequently inspected the Whitehead torpedo-room, where they saw the different parts of this destructive missile, except its secret chambers. Upon adjourning to the upper deck of the *Vernon* they witnessed the laying and firing by electricity of a line of mines merely containing blowing charges. Upon returning ashore they examined several points of interest in the yard. Another section inspected the iron foundry and the *Marlborough*, training ship for engineer students, while a large number went on board the gunnery ship *Excellent*, where they saw some excellent practice with the 110-pounder guns, which were fired separately and as a broadside, the targets varying in range from 601 to 1,100 yards. Afterwards they were taken to Whale Island, where the relative capabilities of the Nordenfelt, Hotchkiss, and Gardner guns were tested, the latter developing the highest destructive powers, and being, it fact, professionally regarded as the machine gun of the future. Upon returning to the dockyard a careful inspection was made of the turret-ship *Dreadnought*, which is the second most powerful monitor afloat in the British navy, mounting, as she does, four 38-ton guns, worked by hydraulic machinery, besides being equipped with all the most modern means of warfare. Altogether, the visit to the first naval port in the world was thoroughly enjoyed by the members, every courtesy being extended to them by the naval and dockyard authorities. At the conclusion of dinner, at Cawte's Hotel, which hospitable event wound up an admirably arranged programme, the President, after the toast of her Majesty had been honoured, acknowledged, on behalf of the Society, the kindness of the Admiralty and of all the officials concerned at Portsmouth, for contributing to a most successful and instructive excursion.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Flaxman.—On August 26th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt & Co., an iron screw steamer named the *Flaxman*, built to the order of Messrs. Lamport & Holt, Liverpool, of the following dimensions, viz.:—Length, 300 ft.; breadth, 36 ft.; depth of hold to floors, 24 ft.; gross tonnage about 2,000 tons. The vessel is built under the three-decked rule, and will take the highest class at Lloyd's. The engines, by the same firm, are on the compound principle, having cylinders 32 in. and 64 in. and a stroke of 42 in., steam being supplied by two single-ended boilers 14 ft. 3 in. diameter. The vessel is fitted with Biemme's steam steering gear, Harfield's patent windlass for lifting anchors, and all the latest improvements. The ceremony of naming the vessel was performed by Mrs. Troughton.

Wykeham.—On August 29th from the Whitehall iron shipbuilding premises, there was launched an iron screw steamer, built to order of Messrs. Robinson, Rowland, & Marwood, steamship owners, of Whitby, being the fifth in succession built by the Messrs. Turnbull for that firm. The new vessel was christened *Wykeham* by Mrs. Christopher Marwood, St. Hilda. The dimensions are:—Length, 240 ft.; breadth, 34 ft.; depth of hold, 17 ft. 9 in.; she is built with poops, raised quarter decks, bridge, topgallant forecastle; classed 100 A1 at Lloyd's. Her engines are by Messrs. Blair & Co., Stockton.

Rive de Gier.—On August 29th the screw steamer *Rive de Gier*, built to the order of Messrs. D. Orbigny & Co., La Rochelle, France, was launched from the Howdon yard of Palmer's Shipbuilding and Iron Company (Limited). The vessel is the second of several which Messrs. Palmer & Co. have on hand for the same firm. Her dimensions are:—Length, 250 ft.; breadth, 33 ft.; depth, 16 ft. She will be rigged as a two-masted schooner, her lower masts being of iron. The accommodation for the master and officers will be in a short, sunk poop; the engineers will be accommodated underneath a short bridge amidships, and the crew will be in a topgallant forecastle. The steamer will have water ballast in fore and after holds. For the rapid discharge of cargo she will be fitted with a steam winch by Clarke, Chapman, and Gurney, at each hatch, and Emerson and Walker's steam windlass. She will have Bow and M'Lachlan's patent steam steering gear. The engines will be supplied by Palmer's Company, and will be of 140-horses power nominal, the cylinders being respectively 30 and 57 in. The vessel has been built under the superintendence of Captain Parry, inspector to the owners, to class A1 at Lloyd's. The ceremony of christening the vessel was performed by Mrs. James Kirkley, of South Shields.

Rivoli.—On August 29th there was launched from the yard of the Tyne Iron and Shipbuilding Company, Willington Quay, a screw steamer, named the *Rivoli*, built to the order of Messrs. Stephens & Mawson, of Newcastle. The dimensions of the vessel are:—Length between perpendiculars, 250 ft.; breadth (extreme), 35 ft; depth to top of floors, 16 ft. Her gross tonnage is 1,800 tons, and she is intended for the Black Sea and Bilboa trades. She will be fitted with engines of 160-horse power by Mr. John Dickinson, of the Palmer-hill Engine Works, Monkwearmouth. The ceremony of naming the vessel was performed by Miss Stephens, daughter of one of the managing owners.

Hesleyside.—On August 29th Messrs. D. Baxter & Co., Sunderland, launched a vessel of highest class at Lloyd's, and built under special for Messrs. Charlton, M'Allum & Co., of Newcastle-on-Tyne. She has exceptionally light draught of water, 12 ft. 6 in. when loaded with a dead-weight cargo of 850 tons, and extra engine and boiler power by Messrs. R. & W. Hawthorn. She was gracefully named the *Hesleyside* by Mrs. W. Charlton, and in ordinary times, is intended for the Bilboa and fruit trades; and is specially adapted for the shallow West Indian and Nova Scotian ports.

Silksworth.—On August 30th, Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of the Marquis of Londonderry, for his Sunderland trade. Her principal dimensions are:—Length b.p., 245 ft.; beam extreme, 34 ft.; depth moulded, 18 ft. 2 in. She is built to Lloyd's highest class, and has long quarter-deck, bridge-house, and t.g. forecastle, water ballast throughout on the cellular principle, iron decks, chart-house, skylights, and companions. She will be fitted with four hatches and steam winches by Clarke, Chapman & Gurney, patent windlass, Holliday's steam steering-gear, flexible steel hawsers, by Bullivant & Co., and will be schooner-rigged. Engines of 130-n.h.p. will be supplied by Messrs. T. Richardson & Sons, of Hartlepool. This vessel is No. 111 in the builder's yard, and the fourth built by them for the same owners. On leaving the ways the steamer was christened *Silksworth* by Mrs. S. J. Ditchfield, of Seaham Harbour.

Ville de Valence.—On August 30th there was launched from the shipbuilding-yard of Messrs. Thompson & Sons, Southwick, Sunderland, an iron screw steamer, 260 ft. long, breadth 34 ft. and 24¾ feet depth in hold to spar deck, which has been built for La Compagnie Havraise Peninsulaire de Navigation à Vapeur, Havre, under Lloyd's special survey for the highest class and French Veritas, also under the personal superintendence of Captain Moutier, who will command her. She has cabin aft (with entrance to same from large smokehouse on spar deck aft protected by hood covering stern). She is fitted up in first-class style for captain and passengers, and has accommodation under spar deck for officers and engineers amidships, and forward for firemen and crew. The vessel has also monkey forecastle, large chart and wheel-house under bridge amidships, look-out bridge forward, water ballast in both holds, four large hatchways, four steam winches and donkey boiler by Messrs. Clarke, Chapman & Gurney, Emerson, Walker & Co.'s patent steam quarter-master steerin gear amidships, patent screw gear aft, &c. She will be fitted wit engines of 150 nominal horse power by John Dickinson, Esq., Sunderland. As the vessel left the ways she was named the *Ville de Valence* by Miss Jones, of Newport, (Mon).

Saltwich.—On August 31st there was launched from the shipbuilding-yard of Messrs. Joseph L. Thompson & Sons, North Sands, Sunderland, a vessel of the following dimensions, viz:—Length, 260 ft.; breadth, 36 ft.; depth, 18 ft. 8 in.; classed 100A at Lloyd's. She has long bridge, raised quarter-deck, full poop, and topgallant forecastle, and is fitted with all the latest improvements, viz.:—Harfield's patent windlass, four steam winches of large size by Rogers, of Stockton; Douglas & Coulson's steam and hand-steering gear combined, also Hastie's patent screw-steering apparatus aft. Engines by Mr. John Dickinson, of Sunderland, 150 horse-power. The cargo carrying space has been divided into five separate compartments by means of six iron bulkheads, has five hatchways of large size, and is fitted up in every respect to meet the requirements of the Grain Cargoes Act of 1880. The vessel has an entire iron deck, covered with wood. Deadweight capacity is about 2,300 tons. The steamer has been built to the order of Messrs. J. H. Barry & Co., of Whitby, and is the fifth vessel built by this firm for the same owners. As she left the ways she was christened *Saltwich* by Miss Thompson, daughter of the senior partner of the firm. She is intended for general trade, and will be commanded by Captain John Claxton, late of the *Rosella* (s), of Whitby.

Waterloo.—On August 31st, there was launched from the shipbuilding yard of Messrs. John Readhead and Co., West Docks, South Shields, a screw steamer, named the *Waterloo*, built to the order of Mr. W. D. C. Balls, of Tynemouth. The vessel measures 255 ft. in length between perpendiculars, 36 ft. beam, 17½ ft. depth of hold. Her engines, built by Messrs. Readhead, will be of 140-horse power nominal, the cylinders being 30 in. and 57 in. in diameter, and the stroke of the piston 36 in., the pressure on the boilers being 80lb to the square in. She will have a long raised quarter-deck, and a topgallant forecastle. The vessel has iron decks, iron bulkheads, and iron shifting boards for the stowage of grain cargoes. She will be fitted with water-ballast in both holds, will have steam winches, and Harfield's patent steam windless in order to facilitate the rapid discharge of the cargo. The deadweight carrying capacity of the vessel is 2,100 tons. The steamer has been built uuder the personal superintendence of Captain Balls to class 100 A1 at Lloyd's. The ceremony of christening the ship was performed by Mrs. Quin, wife of Councillor Quin, of Newcastle. The *Waterloo* is the fourth vessel built by Messrs. Readhead and Co. for the same owners.

Karaweera.—On August 31st, there was launched from the shipbuilding yard of Messrs. Hodgson an d Soulsby, an iron steamer, named the *Karaweera*. She is schooner-rigged, of about 1,415 gross tons, and 990 net. Her dimensions are as follows:—length 250 ft. breadth 35 ft. depth 17 ft. 6 in. She was built to the order of Messrs. Harrold Bros., London. She has compound inverted "D.A.S.C." engines, 140 h.p., 32 and 60—39, built by Messrs. Blair & Co., Stockton-on-Tees.

Constance.—On August 31st. an iron steam paddle trawler was launched by Mr. J. T. Eltringham, Stone Quay, South Shields. The boat has been built to the order of Messrs. W. H. Shawcross & Co., Scarborough, and is of the following dimensions, namely:—Length, 90 ft.; breadth, 18 ft.; depth, 9½ ft. The engines, which will be of 40-horse power nominal, will be built by Messrs. Baird & Barnsley, North Shields, and are upon the jet condensing side-lever principle. The building of the vessel has been under the superintendence of Mr. John Andersen, North Shields. As she left the ways she was named the *Constance*.

Norseman.—On August 31st. a screw steamship, built to the order of the British and North Altantic Steam Navigation Company (Limited), was launched from Messrs. Laird Brothers' Works, Birkenhead, and was named the *Norseman*, the ceremony of christening being performed by Mrs. Eyles Gordon. The steamer is of iron on the longitudinal bracket plan, and has three decks and awning deck. and a most complete water ballast arrangement for 770 tons. Her dimensions are:—Length, 390 ft.; beam, 43 ft. 6 in.; depth, 35 ft. 3 in., with a gross tonnage of about 4,000 tons. She will be fitted with inverted cylinder compound engines of 2,500 indicated horse power.

Glenholme.—Messrs. Campbell, Mackintosh & Bowstead have launched from their yard at Scotswood a cargo steamer, which has been built by them for Messrs. Culliford & Clark, of Sunderland. The vessel, which was named the *Glenholme*, is on the spar deck system, and is to class 100 A1 in Lloyd's Registry, and has been fitted with water ballast tanks, which will contain about 300 tons. The dimensions of the steamer are:—Length, 277 ft.; breadth, 37 ft. 6 in.; depth, 23 ft. 4 in. After the launch, she was taken to Sir Wm. Armstrong's crane, to have her machinery put on board by Messrs. Thomas Clarke & Co., of Elswick Marine Engine Works. She will also be fitted with Emerson Walker's 78 patent combination windless.

Fannie.—On September 2nd an iron screw steamer was launched from the building-yard of Messrs. W. Gray & Co., of West Hartlepool, of the following dimensions:—Length, 257 ft. 6 in.; breadth, 35 ft. 6 in.; depth of hold, 19 ft. She is classed 100 A1, the highest class at Lloyd's, was built to the order of Messrs. C. Nielsen & Son, of West Hartlepool, and is intended for the Indian and general trades, to carry 2,350 tons deadweight. She has a poop aft fitted up for the accommodation of captain and officers, raised quarter-deck, bridge, and topgallant forecastle. She is fitted with double bottom in both holds for water ballast, and is supplied with four steam winches, Higginson's steam steering-gear amidships, and Emerson & Walker's windlass. Her engines are built by Messrs. Blair & Co., Stockton-on-Tees, and are of 140 horse-power nominal. On leaving the ways, the christening ceremony was performed by Mrs. Tomlinson, of Durham.

Rhymney.—On September 2nd there was launched from the shipbuilding yard of Kish, Boolds, & Co., Pallion, Sunderland, a screw steamer of the following dimensions:—240 ft. by 34 ft. by 17 ft. She is built to the order of Messrs. Morel Brothers & Co., Cardiff, has been specially designed to carry a large cargo on a light draught of water, and fitted up with all the latest improvements for vessels of her class, 100 A 1, viz.:—Bow Maclaclan's steam-steering gear, Emerson, Walker, & Co.'s windlass, Clark, Chapman, & Gurney's winches. The engines by Messrs. W. Doxford & Sons, are of the compound direct-acting surface-condensing type, of 150 horse-power nominal. As she glided from the ways the vessel was named the *Rhymney*, by Mrs. C. E. Thompson, of Fulwell.

Henrietta—On September 2nd Messrs. Raylton, Dixon & Co., launched from the Cleveland Dockyard, Middlesborough, an iron paddle-steamer, which was named the *Henrietta*. Her dimensions are—length over all, 97 ft.; breadth, 18 ft. 9 in.; and depth of hold 8 ft. 9 in. She will be fitted with grasshopper side lever engines of 40 nominal horse-power, by Messrs. Kincaid & Co., of Greenock. This vessel has been built to the order of Captain Blacklin, of West Hartlepool, and is specially arranged as a tender for Dutch Government purposes in Java.

Gerarde.—There has been launched from Messrs. C. Mitchell & Co.'s yard, Newcastle, an iron screw steamer of 2,400 tons burthen, built to the order of Mr. Jos. Fawcett, of Sunderland and Newcastle. She is of the highest class at Lloyd's, built under special survey, and is being engined by the Wallsend Slipway and Engineering Company (Limited). She will be fitted with Leonard Watson's patent improved direct-acting steam steering gear. As the vessel left the ways she was named the *Gerarde* by Miss Fanny Fawcett, daughter of the owner.

Ardour.—On September 11th the new screw steamer *Ardour*, built to the order of Messrs. D. Orbigney & Co., La Rochelle, was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Company, Limited. The vessel's dimensions are:—Length 250 ft; breadth, 33 ft.; depth, 16 ft. The engines will be constructed by Palmer's Company, and the cylinders will be respectively 30 in. and 57 in. in diameter, the stroke of the piston being 36 in. The vessel, which has been built to class 100 A1 at Lloyd's, will be rigged as a two masted schooner. The accommodation for the master and officers will be in a short, raised quarter deck; the engineers will be situated underneath a short bridge amidships; and the crew's quarters will be in a topgallant forecastle. She will have water ballast in the fore and after holds; a steam winch, by Clarke, Chapman, & Gurney, at each hold; Emerson & Walker's patent windlass, and every other requisite for the rapid discharge of cargo. The vessel will have Bows McLachlan's patent steam-steering gear. The *Ardour* has been built under the superintendence of Captain Parry, inspector for Messrs. D. Orbigney & Co., for whom Messrs. Palmer have already delivered three steamers, whilst they have five on hand. The christening of the ship was most gracefully performed by Mrs. Fox, wife of Mr. William Fox, of the Leeds Forge Company, whose patent corrugated boilers are now so well known. After a beautiful launch, the visitors, who included Mr. and Mrs. Horsburgh, of Leeds, Mr. and Mrs. Hopkinson, of Huddersfield, Mr. H. A. Brightman and party, of North Shields, and others, partook of refreshments, under the able presidency of Mr. Robert Armstrong, manager of the shipyard department, seconded by Mr. G. R. Palmer. "Success to the ship," coupled with the name of Mrs. Fox, having been duly honoured, the health of "The owners," coupled with the name of Captain Parry, was cordially drunk. Other toasts followed, and the proceedings, which were most successful, terminated.

Lero.—There was launched from the building-yard of Mr. James Laing, Deptford, on Tuesday, the 12th, a finely-modelled steamer of the spar-deck type, of the following dimensions:—290 by 37 by 27, for Messrs. N. and S. W. Pinkney. She is fitted with Emerson, Walker & Co.'s horizontal direct steam windlass. A large number of friends assembled to witness the launch, which was most successful. The vessel was christened *Lero* by Mrs. T. N. Pinkney.

Watlington.—On September 13th, William Gray & Co. launched from their yard at West Hartlepool, an iron screw steamer of the following dimensions:—Length, 268 ft.; breadth, 35 ft. 6 in.; depth of hold, 19 ft. 9 in.; classed 100 Lloyd's; built to the order of Messrs. R. Ropner & Co., of West Hartlepool, under the survey of Captain Rooke. This vessel is intended for the Indian and Mediterranean trade, to carry 2,500 tons. She is built with long quarter-deck and full poop, also long topgallant forecastle, and double bottom for water ballast in each hold. She will have four steam winches, steam steering gear amidships, and fitted with Emerson, Walker & Co's. patent combination windlass. The engines are to be supplied by Messrs. T. Richardson & Sons, of Hartlepool. On leaving the ways the christening ceremony was performed by Mrs. Dennes, of Stockton, the vessel being named *Watlington*.

Eppleton.—On September 14th there was launched from the shipbuilding yard of Messrs. S. P. Austin & Son an iron screw-steamer of the following dimensions:—Length over all, 223 ft.; breadth, extreme, 31 ft.; depth of hold, 15 ft. 2 in.; gross tonnage, 990 tons; nett tonnage, about 632 tons. Built under the superintendence of Mr. G. J. Scott, consulting engineer, of Newcastle, to Lloyd's highest class; constructed with short full poop, brake, bridge-house, and topgallant forecastle, with iron decks, rails, and complete double bottom for water ballast. She will be fitted with compound surface-condensing engines of 110-horse power nominal, Emerson, Walker & Co.'s patent combination windlass, and three steam winches. She is the second boat built to the order of Messrs. Sharp & Co., Newcastle-on-Tyne, off the same model. As she left the ways she was named *Eppleton*. by Mrs. Robert Sharp, jun.

Gardepee.—On September 14th there was launched from the shipbuilding-yard of Messrs. Wm. Pickersgill & Sons, Southwick, Sunderland, a screw steamer, built to the order of Messrs. Morel Brothers & Co., of Cardiff. The vessel is of the following dimensions:—Length, 258 ft.; breadth, 36 ft.; depth, 18 ft. 6 in. Her engines are to be of 140-horse, by Mr. George Clark, Southwick, and she will be fitted with Emerson, Walker & Co.'s patent combination windlass. As the steamer left the ways she was christened the *Gardepee* by Miss Pickersgill.

Cornucopia.—From the shipbuilding-yard of Messrs. Osbourne, Graham & Co., North Hylton, on the 18th inst., a cargo-carrying steamer, built to the order of Messrs. Turnbull, Potts & Co., Managers of the Argosy Steam Shipping Company (Limited), was launched. The steamer, which has been built under special survey to class 100 A1 at Lloyd's for the general carrying trade, is of the following dimensions:—Length, 250 ft.; breadth, 34 ft.; depth to main deck, 17 ft., and to spar deck 24 ft.; with a carrying capacity of 2,200 tons deadweight. She will be fitted with one of Emerson, Walker & Co.'s windlasses, steam steering gear by Higginson, Pinkney's patent topsails, and other appliances of the most recent construction. Her engines, of 150-horse power, will be fitted by Mr. George Clark, of Southwick. The launch was most successfully accomplished, Mrs. Potts, wife of Captain Potts, christening the vessel the *Cornucopia.*

LAUNCHES.—SCOTCH.

Libau.—An iron screw steamer, of about 2,000 tons has been launched by Messrs. Robert Napier & Sons, on the Clyde. This vessel has been built to the order of Messrs. Fraissinet & Co., Marseilles, and is intended to inaugurate their Indian and China service from that port. She will be fitted with compound surface condensing engines of 2,000 horse-power. She was named the *Libau.*

Whampoa.—On August 24th, Messrs. Scott & Co., Cartsdyke, launched from their shipbuilding yard at Greenock, a screw steamer of 1,750 tons, built to the order of Messrs. Service & Sons, of London, for the China trade. She is a vessel 270 ft. long, 34 ft. broad, and 25 ft. in depth, and was named the *Whampoa.* After the launch she was towed to the Victoria Harbour, where her engines will be put on board.

Helenslea.—On August 29th, there was launched from the shipbuilding-yard of Messrs. Alexander Stephen & Sons, of Dundee, a steel barque named the *Helenslea.* He dimensions are as follows:—Length, 243 ft.; breadth, 35 ft. 2 in.; depth of hold, 21 ft. 6 in.; and gross tonnage, 1,355 tons. She is owned by her builders, and will be commanded by Captain Reid, of Aberdeen.

Albany.—On August 30th, at Linthouse, Glasgow, Messrs. Alex. Stephen & Sons launched for Messrs. John Warrack & Co., Leith, an iron screw steamer of about 2,200 tons, which was named the *Albany* by Miss Miller Crabbie, Edinburgh. The *Albany* has been built under special survey to the highest class in Lloyd's. In a full poop aft accommodation is provided for the captain and a limited number of passengers, while the officers are suitably lodged in houses amidships, and the crew in a topgallant forecastle. The engines, which are also by the Messrs. Stephen, are of the most improved compound surface-condensing type, and have cylinders 38 in. and 68 in. diameter, by 48 in. stroke, with ample boilers adapted for a working pressure of 85lbs, and the vessel is provided with water ballast arrangements, Emerson, Walker & Co., patent combination windlass, steam steering gear, steam winches, and all the best modern appliances for practical work.

Louise.—On August 30th, there was launched from the Abercorn Shipbuilding-yard at Paisley, a screw steamer capable of carrying about 200 tons deadweight for the Douglas Steam Navigation Company (Limited), Isle of Man. She was originally constructed for Messrs. M'Kinney & Rafferty, for their fish trade. Dimensions:—120 ft. long between perpendiculars, by 21 beam by 9.9; classed 100 A 1 at Lloyd's. To be propelled by a pair of compound surface-condensing engines, 50 nominal horse power, supplied by Messrs. King & Co., Glasgow, and the vessel is expected to attain a high rate of speed. As the vessel left the ways she was named the *Louise* by Miss Nellie Rafferty. The *Louise* is to trade between Liverpool and the Isle of Man.

Ecclefechan.—On August 30th, Messrs. Robert Duncan & Co., launched at Port Glasgow a four-masted ship for the Village Line of Mr. Thomas C. Guthrie, Glasgow. She was named *Ecclefechan* by Mrs. M'Isaac, Saltcoat, and is of the following dimensions:—Length over all, 307 ft.; breadth, 42 ft.; depth of hold, 23 9-12 ft. with a register tonnage of 2,100 tons. She is built in excess of requirements to the highest class in Lloyd's and French Veritas, and is fitted with every modern improvement and many novel arrangements for efficient and economical working. The *Ecclefechan* will load in Glasgow for Melbourne, under the command of Captain John Dow.

Hanroto.—On the 31st Aug. Messrs. William Denny Brothers launched from Leven Shipyard, Dumbarton, a steel screw-steamer of about 2,000 tons gross measurement for the Union Steamship Company of New Zealand (Limited). On leaving the ways the vessel was named the *Hanroto* by Mrs. Denny, of Meadowbank, Dumbarton. The dimensions of the *Hanroto* are:—Length between perpendiculars, 285 ft.; breadth, moulded, 36 ft.; depth, moulded, 25 ft. She has been constructed of Siemens-Martin steel, under special survey of Lloyd's, and classed in their registry 100 A 1, three-decked. She is built on the continuous cellular bottom principle, with solid floors, and adapted for water-ballast. Throughout the machinery space the structural system of deck-plate frames and hold side-stringers has been adopted. She will have accommodation for 60 first class passengers in poop, and 84 second-class on main deck. The officers and engineers will be accommodated on the midship sidehouses under bridge deck, and the firemen and crew will occupy the forecastle. The vessel will be fitted by Messrs. Denny & Co. with compound surface-condensing engines, having cylinders 38 in. and 68 in. diameter, and the stroke of piston 45 in. While being constructed the *Hanroto* has been under the inspection of Mr. John Darling, superindentent engineer of the company.

Cumbrae.—On August 31st, a screw steamer of 500 tons, built and engined by Messrs. W. Simons & Co., was launched complete from their works at Renfrew. She is fitted with compound engines of 70-horse power, and is named *Cumbrae*, being the last of four steamers constructed by this firm for the Clyde Lighthouses Trust, and named respectively *Toward, Clyde, Cloch, Cumbrae.* Its place in the yard will be re-occupied by a hopper dredger.

Ballaarat.—On August 31st, Messrs. Caird & Co., shipbuilders, Greenock, launched from their yard, for the Peninsula and Oriental Steamship Company, a steel screw steamer of about 5,000 tons gross, and of the following dimensions:—Length, 420 ft.; breadth, 43 ft.; and depth, 36 ft. She has been built to the highest class at Lloyd's; spar deck, and has accommodation for 157 first-class and 48 second-class passengers, a special feature in this connection being that all the berths are fitted with Crosbie's patent iron beds. On the lower deck is situated all the mail and baggage rooms, including a large refrigerator, furnished with all the latest improvements. On the spar deck are six steam winches for the working of the cargo, made by Messrs. James Taylor & Co., Birkenhead; also patent steam windlasses by Messrs. Harfield & Co., and steam steering gear by Messrs. Muir & Caldwell, Glasgow. On the forecastle are a couple of lighthouses. The steamer, which was named the *Ballaarat*, will be supplied with engines of 4,000 indicated horse power by the builders, with cylinders of 56 and 100 in. diameter, and 66 in. stroke.

Sumatra.—An iron steamer, named the *Sumatra*, has lately been launched from the Shipbuilding yard of Messrs. John Elder & Co, Govan. She was built to the order of the Stoomvaart Maatschappij Company, Nederland, and is a vessel of 2,600 tons. Her dimensions are as follows:—Length, 325 ft.; breadth, 37 ft.; depth, 27 ft. She is fitted with engines of the compound inverted cylinder type, with high pressure cylinder 38 in. diameter, low pressure 70 in., by 4 ft. stroke; two double ended cylindrical boilers, 80 lbs. pressure, to work up to 2,000 indicated horse power.

Skulda.—On September 2nd, Messrs. S. H. Morton & Co., shipbuilders, Leith, launched from their yard an iron screw steamer of the following dimensions:—Length, 325 ft.; breadth, 32 ft. 9 in.; depth, 16 ft.; her gross tonnage being 1,150. The steamer, which has been built to the order of Messrs. T. Salvesen & Co., Grangemouth, is intended for the general Baltic trade. She will be supplied with engines, of 120-horse power, as well as all the latest improvements. As the vessel left the ways she was named the *Skulda* by Miss Paterson, daughter of the managing owner. After the launch the steamer was towed round to the Albert Dock to be fitted out.

City of Benares.—On September 11th, Messrs. Barclay, Curle, & Co. launched from their shipbuilding yard, Whiteinch, Glasgow, an iron sailing ship for the East India trade of Messrs. George Smith & Sons. The vessel's dimensions are:—252 by 38¼ by 23. and her tonnage 1,650 tons gross. As she left the ways she was named the *City of Benares* by Mrs. Adair, wife of Captain Adair, who has been long in the employment of Messrs. George Smith & Sons, and who has been appointed to the command of the ship

Union.—On September 12th, Messrs. Russell & Co., Greenock, launched from their yard a four-masted iron sailing ship of 2,300 tons, which as she left the ways was named the *Union.* She is 288 ft. long, 42 ft. 9 in. broad, and 29 ft. 9 in. in depth. She is provided with steam winches and self-acting windlass, and all the latest improvements for rapid loading and discharging of cargo. A feature in her construction is that she will be supplied with two auxiliary screws—one on each side amidships—to be used when the ship is becalmed, the engines for which are to be supplied by Mr. A. M'Lelland, of Glasgow. The *Union* has been built to the order of Mr. Antonio Dom Bordes, of Bordeaux. After the launch the *Union* was towed to Port Glasgow to be fitted out for sea.

Aston Hall.—On September 13th, there was launched at Dundee, by Messrs. Gourlay Brothers & Co., a steamship for Messrs. Alexander & Radcliffe, Liverpool, named the *Aston Hall.*

Her dimensions are as follows:—Length, 360 ft.; breadth, 42 ft. 6 inches; depth of hold, 27 ft. 7½ in.; gross tonnage, 3,700. She is fitted up with engines of 330 nominal horse power; she will be schooner-rigged, and classed 100 A 1 at Lloyd's. She is intended for the Bombay trade, and is fitted up with all modern appliances, including Emerson Walker & Co.'s patent horizontal direct steam windlass.

Hammonia.—On September 13th, the steamship *Hammonia*, built for the Hamburg-American Steampacket Mail Co., was launched from the yard of Messrs. James & George Thomson, at Clydebank, near Glasgow. It may be mentioned that this is the fiftieth vessel which this company has built or purchased for them since their formation in 1848. They have over 60,000 tons of shipping employed in their mail service on three important lines—viz., Hamburg to New York, *via* Havre, Plymouth, and Cherbourg; Hamburg to the West Indies; Hamburg to Vera Cruz. The *Hammonia* is intended for the first of these routes. She is a steel vessel, and is the first mail steamer of that material for which her owners have contracted. She is intended to steam at a mean ocean speed of 15 knots. The machinery for driving her at this speed will be of 5,500 indicated horse power, and is of the three cylinder type. Steam will be provided by four double-ended boilers, 15 ft. in diameter and 18 ft. long, working at 85 lb pressure. Her dimensions are:—Length, 375 ft.; breadth, 45 ft. 6 in.; depth, moulded, 34 ft. 8 in.; tonnage about 4,500. She has accommodation for 100 first-class and 100 second-class, with all the necessary pantries, galleys, smoking room, ladies' parlours, and dining saloons. This accommodation is on the main deck, but on the lower is accommodation for 700 emigrants. She has a turtle-back poop and forecastle, which contain lavatories and other accommodation for the emigrants; also a bridge-house amidships which completely houses the engine and boiler openings, and provides accommodation for the crew and officers.

Nubia—On September 13th, Messrs. D. & W. Henderson & Co. launched from their shipbuilding-yard at Meadowside, Partick, an addition to the fleet of the Anchor Line. The ceremony of naming her the *Nubia* was performed by Miss Graham, daughter of Mr. John H. N. Graham, of Drums, Renfrewshire. The *Nubia* has been built to the highest class, and is of the following dimensions:—Length, 378 ft.; breadth, 40 ft.; depth, 28 ft. 6 in.; with a gross tonnage of over 4,500 tons. She will be fitted by the builders with compound engines of 600-horse power nominal, and will have accommodation of a very superior kind for 60 saloon passengers. The vessel has been specially constructed for the Indian trade, and will be ready to sail from this port for Bombay on October 28th.

Pacaxo.—On September 13th the London and Glasgow Engineering Company launched from their yard at Govan the *Pacaxo*, an iron screw steamer, for the Brazil Steamship Company (Limited), Messrs. Mors le Blanch & Bigland, managers, of the following dimensions:—Length, 235 ft.; breadth, 31 ft.; depth 17 ft.; built to the highest class at Lloyd's and Bureau Veritas. The vessel has been constructed under the superintendence of Mr. G. S. Goodwin, of Liverpool, and will be fitted by the builders with a pair of compound surface-condensing engines, with cylinders 27 and 51 in. diameter, by 36 in. stroke, three powerful steam winches for working cargo, and one of Messrs. Napier Brothers' patent steam capstan windlasses.

Vanduara.—On September 13th Messrs. C. Connell & Co. launched from their shipbuilding yard at Scotstoun a four-masted iron sailing ship of 2,150 tons. She is built with a number of extras beyond Lloyd's requirements for their highest class, and is of great strength, having double bilge and sheer strakes, and an iron main deck right fore and aft, sheathed with 4½-in. yellow pine. Her masts are of steel throughout, combining great strength with lightness, and her standing and running rigging are of the very best material possible. She has a wheel-house on top of poop to protect the steersman, and is also fitted with lighthouses forward with Harvie's patent signal lamps. To assist in working the vessel a powerful engine and boiler are fitted in house amidships, and generally all the latest improvements for the efficient working of the vessel and for the rapid loading and discharging of cargo have been introduced. She is now the fifth vessel which has been built by Messrs. Connell & Co. for the same firm, managed by Captain J. D. Clink. On leaving the ways, she was named *Vanduara*, by Miss Martha Mackay, Pollokshields, daughter of one of the owners. The *Vanduara* will be commanded by Captain Simpson, late of the *Oimara*, and will load here for Buenos Ayres.

Florence.—On September 14th Messrs. Thomas B. Seath & Co. launched from their shipbuilding yard at Rutherglen, a steamship for the west coast of England traffic. The vessel which has been built to the order of Messrs. J. J. Mack & Co., Liverpool, is of the following dimensions:—Length, 150 ft.; breadth, 22 ft.; and depth, 11 ft.; with poop bridge and topgallant forecastle. The engines are compound surface-condensing of 60 nominal horse power; cylinders, 20 in. and 36 in. in diameter by 27 in. stroke, with a working pressure of 80 lbs. The machinery is supplied by Messrs. Wm. King & Co., Glasgow, and it is expected that the steamer, which is classed 100 A1 at Lloyd's, will attain a speed of 11 knots an hour. On leaving the ways the vessel was named the *Florence* by Miss Florence Mack, daughter of the principal of the owning firm.

Brier.—On September 14th Messrs. David and William Henderson & Co., launched from their Meadowside Works, Partick, an iron screw-steamer of the following dimensions:—210 ft. by 30 ft. by 15 ft. 2 in., and 700 tons, which has been built to the order of the Glasgow and Londonderry Steam Packet Company, per Messrs. A. A. Laird & Co. The vessel is fitted with all modern appliances, has accommodation for 40 first-class passengers on the poop, and is adapted for carrying cattle on the main and lower decks. On the vessel leaving the ways she was named the *Brier* by Miss Eardley Wilmot, of Westbourne Park, London. The vessel will be fitted by her builders with compound engines of the most approved design and with all recent improvements, her cylinders being 31 in. and 60 in. diameter by 3 ft. 6 in. length of stroke, and a working pressure in the boilers of 90 lbs. per square in. After being completed the vessel will be placed on the company's Channel service.

George Gordon.—On September 14th, Messrs. Birrell, Stenhouse & Co., launched from their yard at Dumbarton an iron sailing ship of about 1,320 tons gross register, built to the order of Gavin Cower, Esq., Glasgow. She has been contructed to Lloyd's highest class (under special survey), and has all the latest improvements for the efficient and economical working of the ship, including steam winch, windlass, and condenser. This will be a valuable addition to the fleet of the North British Shipping Company. On leaving the ways she was named the *George Gordon* by Miss Loudon, Linwood, Hamilton, and afterwards moored alongside the builders' wharf, where she will be completed, and thence go to Liverpool to load for Melbourne.

Beeswing.—On September 15th, the *Beeswing* (s) was launched from the shipbuilding-yard of Messrs. Dobson & Charles, Grangemouth. This vessel is built of steel to the highest grade in Lloyd's, and to the order of the Universal Steam Shipping Company, London, of which Messrs. Capper, Alexander & Co., of London and Cardiff, are the managers. Her principal dimensions are:—Length between perpendiculars, 230 ft.; depth of hold, 16 ft. She will be fitted with compound surface condensing engines of 120-horse power nominal by Messrs. Hutson & Corbett, of Kelvinhaugh Engine Works, Glasgow, and with the most modern appliances for the taking in and the discharging of cargo. The vessel has been built under the superintendence of Captain Evans, who will take command. The naming ceremony was performed by Mrs. Evans.

Ruby.—On September 15th, the *Ruby*, a screw steamer of about 200 tons burthen, was launched by Messrs. John Fullerton & Co., shipbuilders, Paisley. She has been built for Messrs. Mitchell & Rae, of Newburgh, Aberdeen, for their coasting trade, to the highest class at Lloyd's and under the superintendence of Messrs. M'Nicoll & Smith, Glasgow. Her engines, of about 50-horse power nominal, will be supplied by Messrs. Lees, Anderson & Co., Glasgow. The ceremony of christening was performed by Mrs. Rae, the wife of one of the owners.

Bow Fell.—On September 16th, Messrs. Murdoch & Murray launched from their yard at Port Glasgow a screw steamer of the following dimensions:—Length, 145 ft.; breadth, 22 ft.; depth (hold), 10 ft. 6 in. This vessel has been built to the order of Messrs. Hume, Smith & Co., Liverpool, and forms the fourth of their new "Fell" line. She is classed 100 A 1 at Lloyd's, and is fitted up with all the newest appliances for speedy loading and unloading; she has large hatches and powerful steam winches in every way suitable for the trade for which she is intended. She will be fitted with engines of 65 nominal horse power, by Messrs. Dunsmuir & Jackson, Govan, Glasgow. As the vessel left the ways she was named *Bow Fell*, the ceremony being performed by Miss Fisher Montgomerie, Crescent, Glasgow. The hull and machinery are under the superintendence of Messrs. W. R. M'Kaig & J. Carlton Stitt, Liverpool.

Neto.—On September 16th Messrs. Dobie & Co., launched from the Govan Shipbuilding yard, Glasgow, an iron screw-steamer, classed 100 A 1 at Lloyd's, of about 1,690 tons gross, for the Mediterranean trade of Messrs. Strong, Reid & Page, of Liverpool. The machinery is being supplied by Messrs. Smith Brothers & Co., of the Kingston Engine Works, under the superintendence of Mr. George Hepburn, consulting engineer, Liverpool. As the vessel left the ways she was named *Neto* by Mrs. George Page.

Milton Park.—On September 18th, Messrs. A. M'Millan & Son, Dockyard, Dumbarton, launched this double-bottom iron sailing ship of 1,705 tons, b.m. The double-bottom is constructed on the longitudinal girder principle, and is made to contain 300 tons of water ballast, and is fitted with pumps capable of discharging the whole of it in six hours. She is intended for the East India trade.

Ballina.—On September 1st, Messrs. A. & J. Inglis, shipbuilders, Pointhouse, launched this screw steamer, a vessel of 2,600 tons. The new vessel, which will be fitted with engines of 2,000 horse-power, is of the following dimensions:—Length, 315 ft.; breadth, 38 ft.; depth, 26 ft. She has been built to the order of Messrs. Gray, Dawes & Co. London, for the Queensland trade. She is fitted with Emerson, Walker & Co.'s patent combination windlass.

Parahyba.—This iron screw steamer, of 770 tons, built to the order of Messrs. Fry, Miers & Co., London, and intended for the Brazilian coasting trade, has been launched by Mr. W. B. Thompson, Whiteinch, on the Clyde. She is 200 ft. long, 28 ft. broad, and 14 ft. deep. The vessel will be supplied with engines of 150 horse-power nominal, with cylinders of 30 in. and 60 in. diameter and 36 in. stroke, by the builder from his Tay foundry, and fitted with Emerson, Walker & Co.'s patent combination windlass.

LAUNCHES.—IRISH.

The Ards.—There was launched from the shipbuilding yard of McIlaim & Lewis, Belfast, on August 30, an iron screw steamer, named the *The Ards*, of about 100 tons measurement. This steamer was built for the purpose of trading between Irish, English and Scotch ports, but more particularly for the coal trade between Donaghadee and the English coal ports, in connection with the County Down Railway Company.

Pixie.—On August 31st, there was launched from the Iron Shipbuilding and Engine works of Messrs. M'Ilwaine & Lewis, Abercorn Basin, Belfast, the *Pixie*, a steam barge, built to the order of Messrs. James Fairclough & Sons, Warrington, and intended for the grain trade between Liverpool and Warrington. The *Pixie* is 70 ft. long, 16 ft. 7 in. broad, and 8 ft. 10 in. deep, with a carrying capacity of 80 tons. She is fitted with high pressure engines, with two 12 in. cylinders, having 14 in. stroke.

LAUNCH.—GERMAN.

Nerissa.—On the 13th inst. there was launched from the Flensburg Shipyard, a new screw steamer, built to the order of Mr. A. Kirsten, of Hamburg. She is intended for the trade between London and Hamburg. Her dimensions are, viz:—200 ft. by 30 ft. by 16 ft. 7 in. 100 nominal horse power. She is built to the 1st Dio Veritas. The cabin which contains a saloon, passenger berths, &c., will be fitted up in an elegant style. As the vessels left the ways, she was gracefully christened *Nerissa*, by Miss Olga V. Prutschenko.

TRIAL TRIPS.

S.S. Albertina.—The new screw steamer *Albertina*, recently launched from the yard of Messrs. D. Baxter & Co., Monkwearmouth, built to the order of Messrs. Fisher, Renwick & Co., of Newcastle, had a trial trip, prior to proceeding on a voyage to Havre. The steamer's dimensions are:—Length, 185 ft.; breadth, 30 ft.; depth, 13 ft. She was built under the superintendence of Mr. A. Taylor, of Newcastle, and the engines supplied are that gentleman's patent, by Messrs. Douglas & Grant, Kirkcaldy. They have three cylinders working upon two cranks. The first, or high-pressure cylinder, stands above the second or intermediate one; the piston rod, crank pin, and link reversing gear being common to both these non-condensing cylinders. The third, or low-pressure condensing cylinder, stands aft and alongside of the second cylinder. The first cylinder is 14¼ in. bore; the second 20¼ in.; the third 40 in. The two first cylinders are fitted with hard, separately cast, liners for pistons to work in, and they are steam jacketted. Each piston has a 33-in. stroke. The first cylinder is supported off the second by three wrought-iron turned columns, socketted into both. The second cylinder has its cover made in halves, with a vertical flanged joint, through the stuffing box, so as to get out the piston of the second cylinder without removing any other parts. The low-pressure cylinder is fitted with a gun metal, hand starting valve, having the escape steam led into the exhaust port. The slide valves are of cast-iron; those of the first and second cylinders are balanced, on Dawes' patent, which are found satisfactory. The valve of the third cylinder is two ported for steam and single ported for exhaust. As the cranks are at right angles, a receiver is formed in the casing between the second and third cylinders. The steam pipes are of wrought iron welded tube, 4½ in. bore, ⅝ in. thick, with wrought iron flanges screwed on and brazed. The pistons are cored out hollow, being stiffened by internal ribs, and are fitted with improved steel coils inside of cast-iron packing rings, on Mather & Platt's system. The surface condenser has 650 superficial ft. of tubes, 17 W.G. in brass tube plates 1 inch thick, with glands screwed on cotton packing. The air pump is single acting, with a capacity of 1¾ cubic ft., with Kinghorn & Co.'s patent metallic valves. The circulating pump is double acting, with same valves. The two feed pumps have ball valves. Crank shaft is reversible; has four bearings, each 8½ in. diameter by 13 in. long. The crank pins are 8½ in. diameter by 9 in. long. The cranks are at right angles. Propeller shaft is 8½ in. diameter throughout; intermediate shafting, 7¾ in. diameter. Propeller, of cast iron, 12 ft. diameter; 14 ft. pitch; points of blades set back 6 in. behind after end of boss. The boiler presents no feature of special interest, except that it is very strong, and of the best materials and workmanship, adapted for a daily working pressure of 150 lbs. per square in. It is 11 ft. 8 in. mean diameter and 10 ft. long inside, with 3 furnaces having separate combustion chambers and 182 iron tubes, 3¼ in. external diameter. On the top, a vertical cylindrical dome, 3 ft. 9 in. diameter by 4 ft. high, attached to the boiler by a strong neck ring. The shell of boiler is formed of two rings of Siemens steel plates, each ring consisting of three plates 1⅛ in. thick, double rivetted circumferentially, and butt strapped and treble rivetted longitudinally, with steel rivets 1⅛ in. diameter. All holes in the boiler shell, &c., are drilled in their place. All below the centre line of boiler shell are countersunk outside and in. The boiler was tested with cold water to 300 lbs. and with steam raised by its own furnaces to blow off at 185 lbs. The heating surface is about 1,300 ft., being under 3 ft. per i.h.p. The boiler is covered with silicate cotton and galvanized sheet iron. During the trial the engines indicated 470 horse-power, and the mean speed was nine knots, the vessel being laden. During the trial the engines indicated 470 horse-power, and the mean speed was nine knots, the vessel being laden. During the trip the company on board sat down to an elegant luncheon, which embraced all the delicacies of the season. The chair was occupied by Mr. Geo. Renwick, one of the managing owners of the *Albertina*, and the worthy and indefatigable secretary to the committee of the North-East Coast Exhibition. Amongst those present were:—Mr. Wm. Fox, Leeds Forge Co.; Mr. H. H. Wake, engineer to the River Wear Commissioners, Sunderland; Mr. James Williamson, Lloyd's Surveyor, Sunderland; Mr. H. J. Boolds, Lloyd's Surveyor, North Shields; Mr. D. Stephens, Newcastle; Mr. Walter Charles Church, London; Mr. Geo. Lovering, London; Mr. Hy. Farmer, London; Mr. Jos. Adamson, Manchester; Mr. J. C. Spence, Newcastle; Mr. B. G. Nichol (Donkin and Nichol), Newcastle; Mr. F. W. Durham, London; Mr. R. Horsburgh, Leeds Forge Co.; Mr. George Renwick and Mr. Joseph Fisher (managing owners of the vessel), Newcastle; Mr. Alex. Taylor, patentee of the engines, Newcastle; Mr. W. G. Neal, Editor of the *Marine Engineer*, London. After luncheon Mr. J. W. Williamson, Sunderland, proposed "Success to the firm of Fisher, Renwick & Co," and coupled the toast with the name of Mr. Renwick. He complimented the firm for having gone in for these engines, of which he had always been in favour. The Chairman, in responding, took credit to his firm for having been the first to go in for a pressure of 150lbs. He also remarked that they already had one steamer which has the same kind of engines, and which had run most successfully for over eight months. They were trying them again with another vessel, and he might say again, with this vessel. He also quoted figures to show the advantage of owners going in for a smaller type of engine, with a larger power, to economise the space. He concluded by proposing the health of Mr. Taylor, the patentee of the engines. Mr. Taylor responded and corroborated the chairman's remarks as to the saving obtained by the use of this class of engines. Other toasts followed, and after a most enjoyable trip, the vessel steamed off to Havre, amidst the hearty cheers of the visitors who had been on board of her.

Pavonia.—On September 2nd, the latest addition to the fleet of the Cunard Company made her trial trip. The *Pavonia* has been built by Messrs. J. & G. Thomson, and is a vessel of 5,587 tons gross register. Her dimensions are:—Length, 445 ft.; breadth, 46 ft. 3 in.; depth (moulded), 36 ft. 5 in. This ship, although not large as the *Servia*, possesses internal fittings which render her equally commodious. She is a sister ship to the *Cephalonia*, recently launched and tried on the Mersey. The *Pavonia* is built of iron throughout. She has three complete iron decks, and her outside plating is made upon what is technically called the "edge and edge" system. A feature in structural arrangement of this ship is the great strength and number of her transverse water-tight bulkheads. This large amount of subdivision places her high on the Admiralty list of cruisers, and her great beam will give her a large amount of stability, and thus enable her to carry guns on her upper deck. She is capable of carrying a total deadweight of 5,200 tons, and has all the modern improvements necessary for getting on board and discharging this large amount of cargo with facility. She has five steam winches, and a steam windlass, besides steam steering gear by Muir & Caldwell, two steam engines for driving the electric lighting machinery; and several small engines for wash-deck and bilge pumping service. This ship has in all 45 state-rooms, capable of giving accommodation to 172 passengers, and emigrant berths for 986. The ship is lighted throughout in every part by the Swan electric light. Each state-room has one light, which can be turned on or off at the wish of the occupants. The engines of this ship developed upon trial 4,600 horse-power. They are of the two cylinder inverted vertical type, the cylinders being 53 and 92 in. in diameter, and 5 ft. 6 in. stroke. They have built crank shafts by Vickers, the whole of the tunnel shafting being of S.S. Mersey iron. She has steam and hydraulic starting gear by Brown Brothers, of Edinburgh. This ship, as well as her sister, the *Cephalonia*, is in many respects a new departure in the policy of the Cunard Company, and there is probably no other ship in any of the passenger lines which carries within several hundreds of tons of deadweight of what this ship will carry, and yet she has attained the high speed of 14-5 knots.

Cræsus.—On September 7th the *Cræsus* (s), recently built by Messrs. Kish, Boolds & Co., Pallion, to the order of Mr. Thos. Kish and partners, of Sunderland, proceeded on her trial trip. This steamer is of the following dimensions:—240 ft. by 34 ft. by 16 ft. 6 in., and will carry about 1,750 tons deadweight. The engines, which have been constructed by Messrs. Carr & Co., (Limited), of Sunderland, are of the following dimensions:—28 in. by 54 in. by 36 in. stroke, compound surface condensing, with steam turning and reversing gear, and all the latest improvements in marine engineering. On the run over the measured mile the engines worked up to about 600 horse-power indicated, and the vessel attained a speed of 10¼ knots. After the trial trip the steamer proceeded on her voyage to Bilbao.

Rougemont.—On September 12th the screw steamer *Rougemont*, the latest addition to the fleet of steamers owned by Messrs. John Cory & Sons, of Cardiff, went on her trial trip in the Bristol Channel. The steamer proceeded down Channel to off Lynmouth, where her sea-going capabilities were fairly tested; an average speed of 13½ knots was obtained, with 80 revolutions and 75 lbs. of steam. The following particulars are of interest, as the *Rougemont* is the first steamer of large tonnage which ha been built at Chepstow. She has a carrying capacity of 2,000 tons, and is rigged as a two-masted topsail schooner, has saloon aft for captain and officers, and cabin accommodation for engineers amidships, under bridge house. She has a long raised quarter deck bridge house and topgallant forecastle for crew, with double bottom in fore and aft holds for water ballast of about 250 tons. She has three powerful steam winches, and donkey boiler, Emerson & Walker's patent windlass, Chadwick's patent telegraph, patent steering gear, and all the latest improvements to facilitate dispatch in loading and unloading cargoes. Her engines have been built by Messrs. Black, Hawthorne & Co., of Gateshead-on-Tyne, and are on the compound surface condensing principle. The cylinders are 28 in. and 54 in. with 36 in. stroke, 140 horse power nominal. The boilers are of very large dimensions, and are fitted with Foxes' patent corrugated furnaces, which effect a great saving of fuel, and is the first steamer which has been so fitted in the Bristol Channel. The *Rougemont* is constructed with four water-tight compartments fitted with bulkheads and shifting boards in each hold for the safe carrying of grain cargoes. Messrs. E. Finch & Co. (Limited), Chepstow, are the builders of the steamer, which has been constructed under the personal supervision of Captain Tyacke.

Invicta (s.)—The new Channel steamer *Invicta* has made a very satisfactory trial trip in the Channel, with Mr. Wheatley on board as the Board of Trade inspector. The vessel was in command of Captain Dane, and there were also on board Captain Morgan, R.N., London, Chatham, and Dover Railway, marine superintendent; Mr. Kirtley, superintendent engineer; the Hon. Mr. Duncan, representing the firm of Maudalay, Son, and Field, the builders of the vessel; Mr. Johnson, of the Thames Ironworks Company; and a representative of the firm of Messrs. Brotherhood, who supplied the steering engines and gear. With the exception of a little fault with the steering gear, the result of the trip was of the most gratifying character. The vessel was taken out in mid-channel, and although there was a very heavy sea running, her conduct was admirable. There is no doubt she will prove herself a splendid sea-going craft, with the advantage of being comparatively steady in rough weather.

Leader (*s*).—The trial trip of the screw steamer *Leader*, previous to commencing her first voyage, took place on August 29th. This is the first vessel built under the auspices of the North Durham Steam Shipping Company, the managing owners being Messrs. Hodgson and Eccleston. The *Leader* was built by Messrs. Bartram and Haswell, for the general trade, under Lloyd's special survey, and is capable of carrying 2,200 tons. She has been built to the highest class in Lloyd's, and, in addition to the requirements of this authority, she has an extra bulk head, and a complete iron deck. The steamer has been engined by Mr. John Dickinson, of Palmer's Hill. The engines are of 150 nominal horse-power, the cylinders being 33 in. and 62 in. in diameter respectively, with a 42-in. stroke. The working pressure is 80 lbs. The engines are fitted with patent steam reversing and turning gears, and are expected to develope about 800 indicated horse-power. All the latest improvements for speed and economizing fuel are of course supplied. The telegraph from the engine-room to the bridge is upon Chadburn's reply telegraph system, by which messages may be repeated or replied to with facility in either direction. There is a ballast donkey engine capable of pumping 100 tons per hour, while an ordinary donkey engine is also provided. The Durham steam governor for regulating the speed of the engines in heavy weather is also fitted up. The patent steam steering gear is that invented by Messrs. Cooper & Taylor, and manufactured by Mr. John Lynn, of St. Luke's Engine Works, Pallion. The *Leader* left the South Dock at 2 o'clock with a large number of friends and well-wishers to the North Durham Steam Shipping Company on board. A downpour of rain rather interfered with the pleasure of the start, but later in the afternoon the weather cleared up, and the visitors were enabled to admire the completeness of the vessel and to enjoy the breeze while the *Leader* steamed up and down for the purpose of the compasses being adjusted. The compasses are four in number, all of the newest construction. Two of them are spirit compasses, the one on the upper bridge being an azimuth compass, for enabling the captain to take observations. The speed was next tested, the result being that over a measured distance the *Leader* steamed at the rate of 10¼ knots per hour. The dimensions are:—Length, 257 ft.; beam, 36 ft.; depth of hold, 18½ ft.

Hermes (*s*).—On August 30th the new steamer *Hermes*, which has been built to the order of Messrs. R. P. Houston & Co., Liverpool, was taken out for her trial trip as far as the North-West Lightship, and the result of her preliminary run must have been as satisfactory to the owners as it was creditable to all concerned in the fitting out of the vessel. The *Hermes* is the second ship which has been built for the firm named—the *Hercules* being already on active service—and she will prove a notable addition to the steamers sailing from Liverpool, being intended for the general carrying trade. She was built at Whiteinch, Glasgow, by Messrs. Aitken & Mansel, and is 305 ft. long, has 40 ft. breadth of beam, and 22 ft. depth of hold. She possesses 800 tons water ballast, very powerful pumps, and all the latest improvements in marine architecture, including Messrs. Muir & Caldwell's steam steering gear, Sir W. Thompson's compasses, and Chadburn's engine telegraph. The *Hermes* has been fitted with powerful engines by Messrs. Jones & Sons, of St. George's Engine Works, Liverpool, and the ship has been constructed to carry 3,200 tons deadweight, with 20 ft. draught. She is remarkably well built, and furnished in a manner which has fully satisfied the requirements of Lloyd's surveyor's special inspection, being classed 100 A 1. She has two large boilers and eight furnaces, and is expected to travel at a speed of 10 knots an hour. Her owners claim for the *Hermes* the special merit of having the best modern appliances for loading and discharging. She will be under the command of Captain W. Taylor. The trial trip was of a most pleasant nature, and the steamer returned to the river in the early part of the evening.

Sailor Prince.—On August 31st, the new iron screw-steamer *Sailor Prince*, built by Messrs. Hodgson & Soulsby, Blyth, had her trial trip. This steamer is of the following dimensions:—Length, 250 ft.; breadth, 33 ft.; depth, 17 ft. 3 in. She is intended for the general trades, and will carry 1,600 tons, having been built to the order of Mr. J. Knott, of North Shields, who personally superintended the construction of the vessel. The steamer left Blyth Harbour in the afternoon, and after the compasses had been adjusted the measured mile was run, the vessel having attained a speed of 10 knots an hour. The engines worked smoothly and well, and without a single hitch whatever, the trial having proved most satisfactory to both owners and builders. The steamer, which is under the command of Captain Newton, then proceeded to the Tyne to load for Oporto.

El Dorado.—On August 31st the new screw-steamer *El Dorado*. which was launched from the yard of Messrs. T. W. Smith & Co., North Shields, a month ago, went on her trial trip. The weather was all that could be desired, but a strong sea was running. The trip was regarded as of a most satisfactory kind, the speed acquired, in adverse seas, being equal to 11·2 knots per hour. The owners of the vessel are Messrs. Scrutton & Sons, London, and her nominal horse-power is 160. The *El Dorado* is built for the Demerara trade.

Benbrack.—On September 1st, the screw steamer *Benbrack*, of 2,047 gross tonnage, was taken out for a six hours' trial trip in Liverpool Bay, and proved exceedingly satisfactory to those interested. About three months ago, when this steamer was handed over to the engineers to be refitted with new engines, &c., she was a four-masted vessel, with the engines right aft, and required 400 tons of ballast on board to keep her upright. As she appeared on her trial trip she is a schooner-rigged steamer, with funnel amidships, 600 tons of water ballast on board, and clean swept holds. The speed and consumption with the old engines were relatively 7 knots and 24 tons a day; with the new engines it was 10 knots on 17 tons. She is fitted with Chadburn's engine telegraph. The steamer was handed over by the managing owner, Mr. Joseph Hoult, to the contractors, Messrs. John Jones & Sons, St. George's Engine Works, by whom the whole of the ship and engine work has been effected, the engines having been fitted with all the latest improvements introduced by this firm. The steamer returned to the river after her six hours' trial, during which the engines were run at full speed without heated bearings or priming, and anchored off Egremont.

PRIZES of £100, £50, and £25 are offered by the Committee of the Great International Fisheries Exhibition, London, 1883, for essays, amongst other things:—"On improved facilities for the capture, economic transmission and distribution of sea fishes," including information on "Improved nets and modes of catching salt-water fish, the application of steam to deep-sea fisheries, the advantages of steam carriers, greater facilities to be given by railway companies in regard to rates, refrigerating vans, new and improved fish markets, cold storing rooms for ditto;" also "On improved fishery harbour accommodation for Great Britain and Ireland, indicating the localities most in need of such harbours, the general principles on which they should be constructed, and the policy the State should adopt in aiding and encouraging harbour accommodation for fishing purposes;" and on "The best appliances and method of breaking the force of the sea at the entrance to harbours and elsewhere."

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 22nd August to 21st September.

4016 J. Fleischer (communicated to H. J. Haddan). Piston lubricators.
4022 S. S. Hazeland. Rowlocks and oars.
4027 M. Nenhans (communicated to E. P. Alexander). Dredging.
4040 J. Proctor. Mechanical stokers.
4076 W. B. Espent. Rotary engines and pumps.
4104 L. W. Jelf. Collapsible boats.
4114 J. C. Spence & B. G. Nichol. Wire rope nipper.
4119 G. F. Harrington. Propelling vessels.
4135 A. C. Kirk. Steam engine valve motions and cylinders.
4150 J. Granroth. Steering gear.
4167 C. Mace & J. Brewster. Instantaneous boat disengaging apparatus.
4169 P. M. Crause. Paddle wheels.
4173 E. Lavarenne (communicated to C. D. Abel). Construction of ships and utilization resistance of displacement.
4182 P. J. Messent Shipping coal and bulk cargoes.
4189 A. W. Pattie & G. W. Robertson. Steam engines, particularly three cylinder.
4210 H. Cordes (communicated to A. M. Clark). Discharging bilge water.
4213 J. W. Brown & J. W. Brown, junior (communicated to A. M. Clark). Loading or unloading vessels.
4221 W. Pepper. Apparatus for steering and other purposes.
4239 T Archer, junior. Wire rope holders.
4243 W. Rowden & C. E. Doughty. Sprit sails.
4245 Ignatz Lejda (communicated to W. R. Lake). Rotary engines.
4280 R. Wagstaff. Rotary engines.
4288 J. Dewrance & E. Wimshurst. Steam vessel governing apparatus.
4302 W. J. Plunkett. Indicating and recording amount of salt in steam boilers, &c.
4311 T. Davison. Steering engines.
4325 J. C. Croft. Screw propellers.
4336 A. Beverley & A. Sykes. Governors.
4342 A. J. B. Cropin (communicated to A. L. Reddie). Safety valves.
4374 T. Hyatt. Ships.
4452 J. Gunn. Guard rails for fishing boats, &c.
4478 J. T. Roe. Self-acting, hoisting, lowering, and disengaging tackle.
4483 J. Duffield. Piston ring spring packing.
4502 G. Hughes. Rigging appliances for masts.
4514 J. W. Cook. Temporary partitions.
4518 M. Horsley. Shipping and unshipping rudders, &c.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

August 26th, 1882.

Akroyd, Thomas	2 C	N Shlds.
Allan, David ...	1 C	Glasgow.
Allison, Clifton	2 C	N Shlds.
Anderson, Rbt.	2 C	do.
Brabban, Richd.	2 C	do.
Brown, Alex.	1 C	Lvrpool.
Brown, Andrew	2 C	Glasgow.
Brown, Edwd. F.	1 C	N Shlds.
Conbrough, Alex.	2 C	Glasgow.
DeScriza, Jas. A.	1 C	London.
Fox, Charles W.	1 C	N Shlds.
Henderson, Dvd.	2 C	London.
Hislop, Thomas	1 C	Lvrpool.
Hopson, John ...	2 C	do.
Ingle, George ...	2 C	London.
Ingram, Jas. H. A.	2 C	do.
Keith, Hugh M. D	1 C	do.
Laing, George ...	2 C	N Shlds.
Lamb, James W.	2 C	do.
Lockerbie, C. D.	2 C	Glasgow.
Lush, Edwd. Jno.	2 C	Sthmptn.
Macfarlane, Danl.	1 C	N Shlds.
McInnes, John...	2 C	Glasgow.
Miller, David ...	1 C	do.
Park, John ...	1 C	N Shlds.
Patteson, John	2 C	Glasgow.
Pearson, Robert	1 C	N Shlds.
Philpott, Edwin	2 C	Sthmptn.
Riley, John S.	2 C	London.
Roberts, Hugh	1 C	Lvrpool.
Teague, Thos. C.	2 C	London.
Wallace, Thos.	1 C	Lvrpool.
Watson, Anthony	2 C	N Shlds.
Whyte, John A.	1 C	Glasgow.
Wilkin, Mattw.	1 C	N Shlds.
Williamson, Hny.	1 C	Lvrpool.

September 2nd, 1882.

Cameron, Jas. D.	2 C	Aberdn.
Craig, John ...	1 C	Lvrpool.
Galloway, James	1 C	do.
Godfrey, Thos. S.	1 C	do.
Hankey, Charles	1 C	do.
Hawkes, Thos, A.	1 C	Plmouth.
Macdonald W. A.	2 C	Glasgow.
Mann, David, D.	1 C	Aberdn.
Miller, Thomas	1 C	Glasgow.
Ramsay, Wm.	2 C	London.
Richardson, Jas.	2 C	do.

September 9th, 1882.

Brazier, William	2 C	London.
Bennett, Douglas	1 C	Leith.
Brew, George ...	1 C	do.
Capiter, Osborne	1 C	Hull.
Clarke, William	2 C	London.
Downie, William	1 C	Lvrpool.
Elkington, Francis K. ...	2 C	London.
Elliott, James D.	2 C	Lvrpool.
Ewing, Matthew	2 C	N Shlds.
Fraser, Thomas	1 C	Leith.
Goodman, Jas. E.	2 C	N Shlds.
Gordon, John G.	2 C	do.
Keeman, Edward	2 C	Lvrpool.
Hetherington, T. G.	2 C	do.
Ide, William Aylmore ...	2 C	do.
Lovell, Robert...	1 C	N Shlds.
McLaren, Wm.	1 C	Leith.
Marriott, John...	1 C	Hull.
Miller, James ...	2 C	Lvrpool.
Munay, Archd.	2 C	Grnock
Napier, George	2 C	London.
Penrose, Thomas	1 C	Sndrlnd.
Piril, James ...	2 C	Leith.
Taylor, George	2 C	London
Thaw, William	2 C	do.
Wallace, James	1 C	Grnock.
Westwood, Geo.	1 C	Leith.
Wilkie, John ...	2 C	N Shlds.
Wilson, Joseph	1 C	Lvrpool.
Williams, George	1 C	Dublin.
Williams, Wm. John	1 C	Sundrlnd

September 16th, 1882.

Barnett, George	1 C	N Shlds.
Baxter, Wm. J.	2 C	Lvrpool.
Evans, David E.	2 C	do.
Hawdon, Hny. W.	1 C	N Shlds.
Honest, Thomas	2 C	do.
Huglelie, Olaf C.	2 C	do.
Grieve, John ...	2 C	do.
Hart Charles ...	2 C	Lvrpool.
Hasdell, Robert	2 C	N Shlds.
Matthias, Jno. R.	2 C	Lvrpool.
Mears, Wm. H.	1 C	Sundrlnd
Morgan, Jas. F.	2 C	Lvrpool.
Musker, Charles	2 C	do.
Sanderson, Wm.	1 C	N Shlds.
Smith, William	2 C	do.
Van, Acker Seraphin ...	1 C	do.
Walker, Richard	2 C	Lvrpool.
Wilkie, John D.	2 C	do.
Williams Moses,	2 C	do.

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NOTICE.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, NOVEMBER 1, 1882.

EDITORIAL NOTES.

THE iron ship-builders of America seem to be in a rather bad way. Mr. Roach, the owner of the largest iron shipyard in the United States, has been saying to his friends lately that he sees no future for his industry. It is most amusing, if it were not so pitiable, to see the deluded eagerness with which Canada and many other of our colonies, backed by a small party here who ought to know better, have followed the States in their self-destructive protection tariffs. It is not the foreigners whose imports are taxed that bear the burden of the tax, but the unfortunate inhabitants themselves. Here is a capital instance of it. The whole ship carrying and ship-building trades of the States are crushed out by protective tariffs. The coast trade is reserved by legislation for American bottoms, but what is the consequence of that? The freights are thus kept enormously high for want of healthy competition, and cheap steamers and the traffic is surely being cut off by railway competition. The iron ship yards of the States have been kept comparatively busy for the last forty years in supplying about 290 steamers for this trade to replace the old wooden boats. Mr. Roach, however, sees that this source of work is now exhausted, and has been obliged during the last few years to create a new market by the promotion of a Company to supply pleasure coasting steamers to the watering places in the neighbourhood of New York. This further market is again exhausted, and Mr. Roach expresses his opinion that in a few years grass will be growing in his yards. In the last forty years all the builders together have not obtained orders for more than a dozen steamers for the transoceanic trades. Could the American ship-owners of large sailing tonnage be induced to see the advantage of iron vessels at American prices, a considerable impulse to the trade would be given. But as timber vessels can be built at from $50 to $60 a ton, and plate iron is itself as much as that, iron vessels cannot be built for less than twice the amount of wooden vessels, and the shipowners cannot see their way. On a 1,600 ton vessel the duty amounts to $24,000, and on a 2,000 ton vessel $26,500, either of which sums would suffice to pay the labour bill for timber vessels of an equal burthen. Evidently their only chance for a trade is the repeal of the duty of iron, but in doing that, they attack the interests of the iron and coal industry, for whose benefit the duties are maintained. Thus it is, that the false step of protective duties hurts one trade as much as it appears to foster another, and in any case injures the commercial prosperity of the nation at large. Mr. Roach, driven from his trade by protection, meditates either emigration to France, or diverting his attention and capital to a new business.

SIR J. BAZALGETTE has sent in an elaborate report on the proposed communications across the Thames below London Bridge. He points out the striking fact that, although there are thirteen bridges for the two and-a-quarter millions of inhabitants to the westward of London Bridge, there is not a single bridge for the accommodation of the million-and-a-half inhabitants eastward of that bridge. It is difficult to estimate exactly what effect upon the shipping and wharf interests the erection of a bridge below London bridge might have if it was at all a barrier to the traffic, but we have every reliance upon the engineering skill of the present day that such a bridge might be constructed on several plans which, if not further down than the Tower, need not at all interfere with shipping traffic. We think in any case, should the traffic of the port of London increase, that the tendency will be for dock and wharf accommodation to be gradually but steadily relegated further to the river's mouth. Sir J. Bazalgette advocates a tunnel at Blackwall, costing about £1,250,000, a tunnel at Shadwell, costing about £2,000,000, and a high level bridge crossing the river in one span at the Tower, costing about another £2,000,000. Sir J. Bazalgette is strongly against the expediency or value of a ferry as compared with that of a tunnel or bridge, as its comparative inefficiency and complete failure has been well proved at New York, after a lengthened trial of 50 years.

THE bounty system in France of premiums upon French built bottoms employed on the "long-cours," has naturally given a considerable impulse to French ship-owners to increase their fleets, and to French ship-builders to endeavour to produce them. Many new steamship companies have been formed, and so large has consequently been the demand for iron steamers that the French ship-builders have not been able to supply the market. A very large proportion of the added tonnage has been built in England at much lower rates than the French builders can command, as French built bottoms have the great advantage in the premium or bounty. The Fraissinet Company of Marseilles, though not engaged on the "long-cours," have recently added no less than 16,000 tons of British built steamers, six of which vessels have been built by Messrs. M'Millan & Son, of Dumbarton, who have lately launched the *Taurus*, 1,800 tons for this firm. However much this artificial system of French bounty has served to send grist to our English builders, in choking and artificially raising the prices of their home builders, we cannot refrain from saying that such a system is radically bad, and that we hope our own ship-owners have too much foresight to desire such a state of affairs for themselves. Such bounties never last long. They are essentially a burden on the tax-payers, and if just for one trade are requisite for all. When the burden is suddenly discovered and the bounties repealed, then the artificially supported trades dismally collapse, and the mistake of the whole business is perceived.

THE new pull-out hydraulic buffer on the *Devastation* has been subjected to a series of experiments which we understand have been successful, but that so far the beau-ideal of a perfect compressor has not been realized. There are at present two kinds of frictional and four kinds of hydraulic compressors in use in the Navy, each of which has its special advantages and disadvantages. In the compressors in question the oil requires extreme nicety of adjustment. In one of the turrets the guns rebounded with great violence and did some little damage to the buffers. A perfect compressor has been defined as fulfilling the following conditions:—It should come gradually into action, so that anything in the nature of a blow on the carriage or working parts may be avoided; the resistance offered should be low and nearly constant; it should be capable of adjustment for any length of recoil; it should be automatic, and should hold the carriage when the ship is rolling, without interfering with the running in and out. None of the buffers at present in use, we need scarcely say, perfectly fulfil these conditions.

THE yacht *Namouna*, which belongs to Mr. James Gordon Bennett, of the *New York Herald*, recently visited London in the course of a very extensive tour, which will extend over many months. She is lighted throughout with the Edison system, comprising about 150 A lamps, fed by an L dynamo, driven from a special engine by belting. Although exposed to some severe storms in her passage across the Atlantic to the coast of France, the light fully proved its reliability under stress of weather, nor was there any tendency of the belt to slip. even when the sea was at its roughest. The screw steamers *Tarawera* and *Waikera*, now building by Messrs. Denny Brothers, of Dumbarton, for the Union Steamship Company of New Zealand (Limited), are to be lighted by the Edison Electric Light Company. Each steamer will be lit by about 150 A lamps of 16 actual candle power, supplied by an Edison L dynamo, driven direct by a Brotherhood engine.

R. R. BEVIS'S PATENT FEATHERING SCREW PROPELLER.

IN addition to the many interesting engineering novelties at the recent North East Coast Exhibition, already noticed in these columns, we are glad to be able to place before our readers this month, a two page engraving of Mr. R. R. Bevis' patent feathering screw propeller, which has been so successfully introduced by Messrs. Laird Bros., of Birkenhead, and which was exhibited by this firm at Tynemouth.

Mr. R. R. Bevis, the well-known engineering manager in Messrs. Laird's establishment, seeing that a screw propeller of the ordinary kind, whether fixed or revolving, was a heavy drag against speed and handiness in sailing, and knowing the objections appertaining to the feathering arrangements hitherto proposed, designed the plan we now illustrate, and patented it in 1868. The object of the invention is to enable the angle of the blades of a propeller to be altered in place under water to the pitch most suitable for working with steam under varying circumstances, as well as to feather them in a fore and aft direction when the vessel is under sail, and the steam power not in use. The blades are moved by a system of levers entirely enclosed within the boss of the propeller, connection with the interior of the ship being obtained by a sliding rod passing through the centre of the shaft, and worked in the screw shaft tunnel. The arrangement is, therefore, free from the objections belonging to the plans previously proposed for accomplishing the same effect, these generally requiring external gearing and machinery about the propeller of a more or less cumbrous form, and extremely liable to derangement, or an internal revolving or reciprocating shaft inside the propeller shaft, which involved considerable uncertainty in action. Appliances for lifting the screw in order to shift the blades had also been tried, but this was a laborious operation, and required a large hole or well through the ship's counter.

With Mr. Bevis's invention, the operation of altering the pitch, or of feathering the blades to any angle, is accomplished in a few minutes, without in any putting the engines in such a position that they could not be at once used in an emergency. It was first applied to a yacht, in the year 1869, and gave such satisfactory results, that since that period it has been fitted to a very large number of vessels, both in the Royal Navy and other services, and several are now in hand for steamers in course of construction. The propeller exhibited at Tynemouth was for H.M.S. *Dolphin*, and the engines which have been constructed by Messrs. R. & W. Hawthorn, of Newcastle-on-Tyne, were also shown. The system is most admirably adapted for ships of war, sailing ships with auxiliary power, or yachts, where it is as important to have as good results under sail alone as under steam.

MESSRS. MERRYWEATHER & SONS have just completed four of their Steep-gradient Steam Tramway Locomotives for a line in Spain. These engines are not fitted with water condensers, but have a patent superheating arrangement, similar to that introduced by the above firm on their Fire Engines in 1861.

LUMINOUS PAINT FOR NAVIGATING, SUBMARINE, AND SHIP PURPOSES.

(*Continued from page* 189.)

SOME important testimony is also given by the master mariners' and other nautical authorities in support of the utility of luminous sea buoys, which we think important to be notified to our readers. Some of these masters in the service of the Southampton, Isle of Wight, South of England, Royal Mail Steam Packet Company, Limited, stated in January last, that as they had occasion to make daily passages to the Isle of Wight, and that in the dark, they had much pleasure in giving their opinions of Balmain's patent luminous paint for marine use, as they found "the Black Jack Buoy of inestimable value, as compared with a buoy coated with ordinary white paint, which would be quite invisible on a dark night, whereas this one is easily seen at a distance of at least two hundred yards," and they thought "that if other buoys were treated in a similar manner it would be of great assistance to navigation." The Harbour of Southampton gave in the following month an equally favourable opinion upon the useful illumination of this buoy, and added that upon inspecting it a few evenings ago he "was surprised to find that the paint had maintained its luminous power, notwithstanding the exposure of nearly five months." The conspicuous serviceable light of one of these kind of buoys is very strongly evidenced by a statement from Captain Rowsell of the Royal Mail Paddle Steamer *Arno*, on the 22nd of the last-mentioned month, when he says, "On one of my recent passages between St. Thomas and Porto Rico I was called between midnight and 1 a.m, by the officer of the watch, who told me that he had altered the course to avoid running over something shining in the water ahead. Coming out of my cabin I saw the object within a few yards, and quite puzzling all of us as to what it could be. On arriving in port I was informed it was a Balmain's Painted Deep Sea Cable buoy. It was seen about a quarter of a mile, and in time to allow the helm to be altered. The ship was making eight knots, night dark, seven hours after sunset. I consider your paint is particularly invaluable for coating buoys, and cannot but be of the greatest service to those navigating buoyed channels at night."

The importance of the application of Balmain's luminous paint to life buoys cannot be exaggerated. Such an apparatus thrown to a man overboard will frequently save his life. Little use, however, is likely to result from throwing such a buoy on a dark night if not illuminated, as it can neither be seen by a man in the water or by those on board the ship, from which it is thrown. On the contrary, if it be coated with the new luminous paint it would at once attract the attention of a person who fell overboard, as well as better enable the rescuing boats' crew to steer for him. We are informed that Vice-Admiral Phillemon and Captain Prowse, R.N., who were jurors at the Norwich National Fisheries Exhibition of 1881, awarded the Government silver medal to the luminous life-buoy. One of such buoys which had been painted for six months was tested by the Rev. F. Williamson, President of the Ballantrae branch of the Royal National Lifeboat Institution, and as the result of his experiment he reported to Admiral Ward that at three o'clock in the morning on the 13th of April, 1881, it then being eight hours after sunset, the luminous buoy was thrown into the sea from the pier, and although its brightness had materially diminished it was very clearly seen, and that far on in the morning he was satisfied it was bright enough for all practical purposes, and that he considered the luminous life-buoy a great success. The Commander and the chief and second officers of the S.S. *Conway Castle*, of Donald Currie & Co.'s line of Castle Packets, have subsequently confirmed the foregoing statement by saying that "having made a practical trial of the light-giving properties of a life-buoy coated with Balmain's Patent Luminous Paint, which was thrown overboard attached to a log line, state that at a distance of fifty yards it was easily distinguishable as a point of light in the phosphorescent water in the wake of the ship." A further very important statement in favour of the use of a life-buoy coated with Balmain's Luminous Paint was made last July to the agents of Messrs. Ihlee & Horne by Mr. Murray, the principal officer of the Board of Trade at Leith, who said, after experimenting with a model life-buoy at night coated with this paint, "I find it to possess all the properties claimed for it, as it continued to glow in the dark in a very serviceable manner for at least twelve hours after removal from diffused daylight. I shall therefore have much pleasure in showing and recommending it to the various seafaring people who frequent this office, and will also lend it to the Superintendent of the Mercantile Marine Office for the same purpose."

In order to cause a successful illumination of buoys, it is absolutely necessary that they should be systematically coated with Balmain's luminous paint, and many failures have occurred by not following the plain directions given with each parcel of the paint. It is stated in some recent printed observations by Messrs. Ihlee & Horne for the use of purchasers of the compound, that the best form of buoy is one sitting well out of the water, and if painted in chequers, vertical stripes, or bands, it is preferable to being all luminous, as it provides for the semi-dark nights. The buoy should not be in a position near where lights already exist. Having had two or three instances in which failures have been due to the non-observation of the foregoing paragraph, we will call particular attention to this, otherwise the effect of the luminous paint will be lost, as it is only intended to show where no other means of lighting exist. One instance in particular deserves special mention. A buoy properly painted was placed immediately in the rays given from a fixed light, consequently the paint was absorbing light instead of giving it out; the fault being in the position in which it was placed. Care should be taken to coat iron rings or other projections likely to damage the luminous paint by rust with iron paint. A dark night should be chosen when inspecting a buoy coated with this paint, and if possible a comparison should be made with another coated with lead paint, when it will be noticed that the luminous buoy is easily distinguishable, and the other one totally obscured. Iron buoys not having previously been painted should first have a coat of iron paint, then two coats of neutral base, and three of the luminous paint, allowing it to dry at least one day between each coat, and three days after the last previous to varnishing. If already painted, the iron paint may be omitted except on parts likely to spoil the luminous paint with rust water. Wooden buoys do not require iron paint except on the iron work. The paint being ready for use no admixture of any kind is necessary. It should be well stirred from the bottom of the tin when first opened, and also each time a brush load is taken, as it settles very rapidly.

Professor Heaton rightly mentioned at the meeting he addressed at the Society of Arts that one of the greatest difficulties in sub-marine work arises from the intense darkness. By the use of Balmain's patent luminous paint, however, the armour of divers can be so painted that they will be able to take down with them into the water such a stock of luminosity as will materially assist them in their submarine operations. Mr. Hedger, the Superintendent of the Southampton Dock Company, has informed Messrs. Ihlee & Horne that a diver, whose dress was coated with Balmain's luminous paint, "descended on a somewhat murky day into 27 feet of not very clear water, and found that he was able to distinguish the bolt-heads and mussels on a ship's bottom with ease."

Much good would also be done to avoid collisions at sea, which are exceedingly numerous, if spars and masts were painted with the luminous compound. Compass cords, and the handrails about landing stages, should also be coated with this paint. It is said that a luminous band painted round a ship of at least a foot in width would show its position, and iron vessels which were lying along a quay on a dark night would often escape damage, whilst those which were surrounded with a band of 6 feet would be observed from a distance if the lamps should happen to go out. "Under favourable conditions such a surface on a dark night would be visible over a mile—a vessel so painted and becoming a derelict would automatically light itself up, and might well prevent fast going steamers from wrecking themselves by running into such derelicts." We think the recommendation a good one, that all fishing smacks should have their numbers painted in large figures with Balmain's luminous paint, so that those boats causing collisions or trespassing should be known on the darkest nights, and thus prevent them escaping without detection as they now do under the cover of night obscurity.

A very appreciable adaptation of this luminous paint is that of the portable or Aladdin's lamp, which merely consists of an oblong wooden board 3 feet by 2 feet well painted. This after exposure to daylight emits sufficient luminosity to show the pattern of a wall paper and several articles in a dark room. In a perfectly dark room which Messrs. Ihlee & Horne kindly permitted us to inspect upon their premises, we could distinctly perceive all the articles in it as well as read a printed notice. There is less trouble with this kind of lamp than any other. Nothing further is required to replenish it with light than to hang it up anywhere where it can receive such, when a sufficient amount can be immediately absorbed to render it distinctly luminous for at least ten hours. If daylight cannot be obtained for it, it can be fully charged with luminosity from artificial light produced by burning an inch or two of magnesium tape before it, or from the flame of a ship's lantern, these luminous boards are particularly serviceable for lamp and spirit rooms, powder magazines, and dark passages on board ships, as well as ship's lock-up, and those passenger's cabins in which lamps are prohibited. Several of these luminous Aladdin lamps are in actual use in some of the British men-of-war for their magazine and spirit rooms and dark passages.

To properly perceive the effect of Balmain's luminous paint, it is essential that the pupil of the eye should be in a right condition, and therefore before being able to duly appreciate the luminosity of a surface coated with this patent compound by a person who has entered a dark room from daylight, he must wait a few minutes before looking at the new light.

Messrs. Ihlee & Horne also kindly showed us their luminous room which in its ordinary state is quite dark. The ceiling was painted with three coats of Balmain's new paint, and this after being exposed to daylight emits such an astonishing quantity of luminosity whereby not only are the articles in the room distinctly visible, but individuals of ordinary good eyesight could without difficulty read and write for hours by the light.

In conclusion, we are glad to learn that Balmain's patent luminous paint is now largely used for marine, sub-marine, ship, and general purposes, and is rapidly growing in the estimation of superior naval and mercantile marine officials and eminent scientists, as well as in that of others who have considered its splendid results and its excellent inestimable capabilities.

THE CARPENTERS OF THE ROYAL NAVY THEIR DUTIES, RESPONSIBILITIES, AND NEGLECTED POSITION.

(*Continued from page* 167.)

IN noticing the methods tried by the Government to raise the numbers and standard qualifications of the carpenters, shipwrights, &c., of the Royal Navy, we will first notice some of the supposed inducements set forth for the purpose of augmenting the staff of artificers placed under the carpenter to carry out the various duties devolving upon him. At the present time and for years past he has practically had no shipwright staff. Owing to the great scarcity of these artificers, the Admiralty have been endeavouring to induce the apprentices from the Government dockyards to join the Navy, but without success.

The reason is obvious. Before the lads are entered as apprentices in the Government service they must produce evidence of respectability and good character, undergo a medical examination, possess certain physical qualifications, and pass a civil service examination of a most trying character.

Supposing there are to be twelve entries, of which six are to be shipwright apprentices, the six who obtain the highest number of marks are selected for this branch, the remainder being entered as millwrights, blacksmiths, plumbers, and caulkers; others not being successful in obtaining the requisite number of marks are rejected, many being afterwards entered as machine or rivet boys, and passing through different grades ultimately become fitters. These young men go on working together, the one as a jobbing class of boys and the other as indentured shipwright apprentices bound to the Queen by proxy for a term of seven years. The shipwright apprentices form eventually the body from which the staff of dockyard officers up to the directors of naval construction are selected to design and superintend the construction of our men-of-war. As this is the case, these apprentices attend school nearly half of their time for the first three years of their apprenticeship, where they are instructed in the higher mathematics and geometry of shipbuilding. Every six months they undergo a searching examination, and are placed on a list in order of merit. The other portion of their time is occupied in becoming acquainted with all the practical details of every branch of shipbuilding, both in the shops, and at the dockside. At the termination of five years the youths who have made most progress in their studies, both practical and theroetical, are formed into a superior class and sent to the Royal Naval School at Greenwich to qualify for high positions in the civil service. Those who have not succeeded so well remain in the dockyards, qualifying themselves either in the mould loft, drawing offices, or other offices, for positions as leading men, writers, and foremen.

As we mentioned before, about 20 years ago the Government became alive to the fact that a better class of artificer was required in the shipwrights staff of our men-of-war. At that time a great revolution had taken place in the ships composing our navy. In fact, within the last quarter of a century, greater strides have been made and entire changes in construction of men-of-war than in 200 years before. The old wooden line of battle ship, the frigate and corvette, which were built entirely of wood, has been swept away, and in their place has arisen massive iron hulls, divided and subdivided into a complication of compartments, every portion of which teems with new styles of workmanship, the whole forming a stupendous structure of the most complicated engineering skill and detail.

The Admiralty then being desirous that their own apprentices should enter the service of the royal navy, offer inducements (so called) as follows. The addenda to the Queen's regulations, page 264, states:—

"All apprentices entered in the dockyards will be liable to be employed during the last two years of their apprenticeship, or part of that time, on board Her Majesty's seagoing ships in commission. On the expiration of their period of service they will receive a certificate of their character and conduct, and the progress they have made in their trades. If this certificate be favourable, it will receive due consideration when any of these young men shall be candidates for promotion, either as carpenters' mates, or as inferior officers in the dockyards."

But should they remain in the dockyards as writers, leading men, &c., their pay would be as follows, compared with that of the navy.

DOCKYARD.	Per diem. s. d. s. d.	NAVY.	Per diem s. d. s. d.
		Engine room artificer	5 0 to 5 9
Shipwrights	4 6 to 5 0	Shipwright	2 3 ,, 2 6
Writers, &c.	6 0 ,, 8 0	Chief carpenters and carpenter's mate	2 6 ,, 3 0

Here, then, is the supposed inducement held out to these educated and skilled young men to join the Navy, the position of carpenter's mate is offered them with a daily rate of 2s. 9d., and 3d. per day tool money; to wear sailors' dress, and mess on the lower deck, assist in scrubbing and cleaning decks, and to wash, make, and mend his own clothing as any ordinary blue jacket. Against a position in the dockyard in a comfortable office with a rate of pay varying for 6 to 8 shillings per diem.

On the other hand, engine room artificers are wanted for the engineer department, the candidate must be either a fitter, boiler smith, coppersmith or pattern maker; in fact, the same class of young men who fail to pass for shipwright's apprentices. Should they, however, join the navy they are entered as engine room artificers, with the rating of chief petty officers at 5s. per diem on entry, with a suitable uniform and superior mess accommodation.

From this it will be seen that the pay of the engine room artificer is double that of the carpenter's mate, but the same as a shipwright on shore, and the maximum rate of carpenter's mates is only 3s., just one half the minimum rate of writers, &c., and yet the Admiralty offer the carpenter's mates position as equivalent to writers, leading men, &c.

Should they, however, join the navy and eventually become carpenters, they would only receive 5s. 6d. per diem, or only 6d. more than the shipwright on shore, and 3d. less than the engine room artificer. The latter being a workman with no particular qualifications or responsibilities, whilst the rank of carpenter can only be attained by well educated practical and theoretical shipwrights by steady perseverance and good conduct, and by passing very strict examinations. By remaining in the dockyard these young men would after 7 years' service as a writer, &c., receive 8s. per diem, but in the navy they would have to serve say four years as carpenter's mate, and 15 years as carpenter, making a total of 19 years' service before receiving that rate of pay.

At the present time the scarcity of skilled shipwrights in the Royal Navy has become a very serious matter, but one that could be easily remedied by introducing a class of naval artificers paid in proportion to their qualifications and responsibilities.

The present pay, position, &c., of carpenters is as follows:—

	In sea going ships and harbour or stationary ships abroad. per diem. s. d.	In other ships. per diem. s. d.
Carpenters under 5 years' service ...	5 6	5 6
,, over 5 ,, ,, ...	6 9	6 0
,, ,, 10 ,, ,, ...	7 9	6 9
,, ,, 15 ,, ,, .	8 3	7 3
Chief carpenters limited to twelve in number	9 0	9 0

We now come to some of the very moderate suggestions for the improvement of their position which the shipwrights and carpenters respectfully wish to bring to the notice of the Lords of the Admiralty.

A few suggestions for the improvement of the shipwright department of the Navy, and the *Head* of the same, otherwise known has the carpenter.

That all the men entered as shipwrights should pass an educational test previous to passing the practical examination, and that in no case should any person be allowed to pass by *strong recommendations* from this or that official of either the Navy or Dockyard.

That seeing the Dockyard Officers are entirely responsible for the class of men in Her Majesty's Navy, a more strict examination should be enforced, and that at the passing of men two carpenters should be compelled to attend as a guarantee; and in no case should they be allowed to offer themselves as candidates without first handing in their indenture or certificate of seven years' apprenticeship to a shipwright.

That all men on entry should be given the same position and pay as the men entered for the other mechanical branch of the service, for by that means the Navy would not be found wanting of good men, as a "stimulas" would be given for dockyard apprentices to join.

That the cognomen of carpenter be altered to shipwright officer and chief shipwright officer.

That being officers of the civil branch of the service, we request to be allowed to wear a distinguishing stripe of lace on the arm, and all chiefs to wear two, the same as other heads of departments.

That shipwright officers be allowed to assume the rank and title of chief shipwright officer after having served 15 years as a shipwright officer.

That the pay of shipwright officers should commence at 6s. per diem, and increase by increments of 1s. every three years up to 24 years' service, after which time to being pensioned the pay should be 15s. per diem.

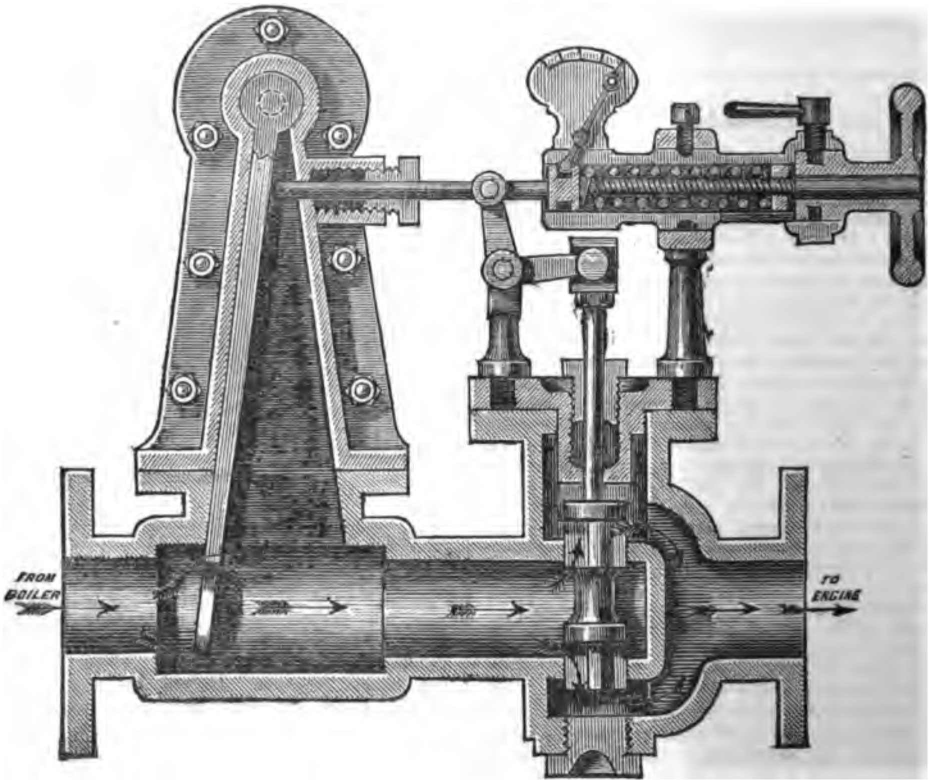
That a system of charge pay be introduced commencing at 1s. per diem for all ships up to 2,000 tons, after which a rise of 3d. for every 1,000 tons or part thereof to be paid in addition.

That in no case whatever should any person be allowed to pass for a carpenter (shipwright officer) that had not sent in his indenture or certificate of seven years' apprenticeship to a shipwright to the Commander-in-Chief or other senior officer ordering the passing day, the same indenture to be handed to the officers holding the examination.

AN ELECTRIC LAUNCH.—Professor Sylvanus P. Thompson has written an account of a trip on the Thames in a launch propelled by electricity. He says:—"At half-past three this afternoon I found myself on board the little vessel *Electricity*, lying at her mooring off the wharf of the works of the Electrical Power Storage Company at Millwall. The little craft is about 26 ft. in length, and about 5 ft. in the beam, drawing about 2 ft. of water, and fitted with a 22-in. propeller screw. On board were stowed away under the flooring and seats, fore and aft, 45 electric accumulators of the latest type as devised by Messrs. Sellon & Volckmar. Fully charged with electricity by wires leading from the dynamos or generators in the works, they were calculated to supply power for six hours at the rate of 4-horse power. These storage cells were placed in electrical connection with two Siemens dynamos of the size known as D 3, furnished with proper reversing gear and regulators, to serve as engines to drive the screw propeller. Either or both of these motors could be 'switched' into circuit at will. In charge of the electric engines was Mr. Gustave Phillipart, jun., who has been associated with Mr. Volckmar in the fitting up of the electric launch. Mr. Volckmar himself and an engineer completed, with the writer, the quartette who made the trial trip. After a few minutes' run down the river, and a trial of the powers of the boat to go forward, slacken, or go astern at will, her head was turned Citywards and we sped silently along the southern shore, running about 8 knots an hour against the tide. At 37 minutes past 4 London Bridge was reached, where the head of the launch was put about, while a long line of onlookers from the parapets surveyed the strange craft that without steam or visible power, without even a visible steersman, made its way against wind and tide. Slipping down the ebb, the wharf at Millwall was gained at one minute past 5, thus in 24 minutes terminating the trial-trip of the *Electricity*. For the benefit of electricians I may add that the total electro-motive force of the accumulators was 96 volts, and that during the long run the current through each machine was steadily maintained at 24 ampères. Calculations show that this corresponds to an expenditure of electric energy at the rate 3 1-11-horse-power."

THE "GRAFTON-JONES" PATENT STEAM ENGINE GOVERNOR.

THE effective governing of Marine Steam Engines is a problem of great importance, one that has engaged the attention of many engineers, and yet one that seems peculiarly difficult of solution even by our most eminent mechanicians. The Marine Engine Governors which can even pretend to efficiency, we dare not say perfection, can be counted, we should suppose, on the fingers of one hand. The commercial success that has attended these few, bears striking testimony to the reality of the want which they are intended to supply, and to the degree of adaptability to their purpose which they have displayed.



The more recent developments in our ocean steamers have intensified the necessity for an efficient governor, that is, for a satisfactory check on "racing." The mere idea of a screw steamer is sufficient indication thereof. We there find practically the whole load placed on the screw, the screw itself being fixed at the extremity of a long shaft, such length becoming excessive in many of our more modern vessels. This screw is liable at any moment to be wholly or partially lifted out of the water, and thus freed from its load; and with equal suddenness to be again submerged and subjected to the most violent strain. The excessive shocks thus dealt to the propeller shafts and the engines, not only gradually pave the way for future disaster, but, not unfrequently, end in sudden accident and fatal loss. This is all matter of course, and matter too of great anxiety to marine engineers, but it is not always so fully realized by their owners. In any event, owners and engineers alike should only too gladly learn of the invention of a satisfactory means of relieving them from so conspicuously difficult a position.

That such a governor should be automatic, goes without saying; but this is hardly sufficient. The cause of racing in marine engines is so sudden, and the resulting prejudicial influence so instant, that the engine must almost be anticipated and held fast before it even attempts to run away. It is too late if it has to be caught and brought back to its normal rate. There are also mechanical difficulties to be taken into account. The want of a permanent level foundation and the exigencies of space and position, present obstacles not easily overcome. Such have, however, been fairly met, not, as is too frequently the case, merely avoided or got round, in the "Grafton-Jones" Governor, which claims to be "anticipatory and automatic," effective, silent, simple, and durable. We give a sectional drawing which will enable our readers to understand the working and principle of this patent. The leading feature, it will be seen, is a disc placed in the main steam pipe, and connected by means of a rod and bell crank, with the spindle of an equilibrium throttle or regulating valve. If the disc hang free in the current of steam passing from the boiler to the engine, it will move forward in the direction of the flow of steam and close the valve, because the pressure exerted on that side of the disc, presented to the current of steam is greater than that on its other side. The extent of this forward movement is controlled by means of an adjustable spring, so as to regulate the admission of steam to the engine at the working pressure, or the number of revolutions desired according to the load on the engine. Having thus adjusted or rather balanced the Governor, it is evident, that should the load or any portion of it be removed from the engine, a corresponding effect is produced on the Governor immediately, that is, the balance set up will be destroyed, and consequently the disc will move forward and close or partly close the valve. On the load or any part of it being resumed, the same considerations prove that the valve will open, in whole or in part, immediately, owing to the reaction of the spring.

This Governor is found to be so extremely sensitive, that when properly adjusted, every movement of the piston is regulated, the slightest variation in the velocity of the steam in its passage to the engine, producing its corresponding effect on the Governor. The regulation is therefore produced by the variations in the velocity of the steam in its passage to the engine. This Governor, it will be seen, lays claim to several important advantages. It is entirely independent of the engine, requiring no driving gear, and being fitted in the main steam pipe like an ordinary steam valve. It can also be fixed without detriment in any position vertically, horizontally, or upside down, and can while running be adjusted to any number of revolutions or pressure of steam. The "Grafton-Jones" Governor has undergone a very severe trial on board the *Storm-Cock*, a sea-going screw tug, working in the Channel and mouth of the Thames. The comparatively small size and great power of this tug rendered the satisfactory governing of her engines a very difficult task, yet the owners report that "the engines were entirely under the control of the governor in all weathers." Such evidence is eminently satisfactory, and we would therefore commend this apparatus to the attention of all interested in marine engines.

AVALANCHE MESSENGER.

We have been favoured by Messrs. Redknap & Penhey, Twickenham, with a sample document which had been taken out of one of their sea messengers after knocking about at sea for a period of two months. The preservation of the document is every thing that could be desired, it being only very slightly stained by the sea water. The messenger was thrown overboard in the Bay of Biscay, from the steam-ship *Mircea*, Captain Jarvis, on August 4th, 1882, and was recovered by a Spanish pilot boat off Stantona early in October. The use and value of such a messenger is obvious; not only could accurate information of loss at sea be communicated with certainty, but the mails or valuable documents of private passengers, might, in that way be preserved. We should think that ready settlement of insurance claims without possibility of doubt, by the receipt of such definite information, would suffice to make both underwriters and shipowners combine to make all vessels carry these "messengers." Shipowners might well make a handsome profit on such outfit, by hiring the same to passengers for use, under a possible contingency, to preserve valuable private documents. Messrs. Redknap & Penhey's avalanche has special individual features of value. It is fitted with a mast and flag, so as to be readily perceptible by day, and being painted with luminous paint would attract forcible attention at night. It is, of course, very buoyant, easily closed, and when closed quite water-tight.

THE NORTH-EAST COAST EXHIBITION OF NAVAL ARCHITECTURE, ETC., AT TYNEMOUTH.

(Continued from page 184).

The exhibits comprised under Fisheries and Life Saving Appliances, though perhaps not strictly belonging to Marine Engineering, are yet, we think, of sufficient interest to the majority of our readers to warrant our devoting a little space in describing some of the chief objects of interest in these two sections. The part of the building devoted to them was the Aquarium, situated in the basement below the Winter Garden in which the models were shown, and during the day as well as in the evening, it was illuminated by six Pilsen arc lamps, the electric current being supplied by a Schukert dynamo in another part of the building.

Mr. Richard Cail, of Newcastle-on-Tyne, exhibited a model of his well-known lock swimming salmon pass, for enabling the heaviest spawn laden salmon to swim in unbroken water without fatigue from a low to a high level, even if the difference in height be as much as 100 feet. A small quantity of water will work this system, which can be regulated exactly as required, and as it is self-acting, it suits itself to any height of water in freshes or floods. Fish and water being of nearly the same specific gravity, it imposes proportionately much less exertion on the fish to ascend 100 feet by this pass than for a man to go the same height by a staircase.

A handy hauler or winch, for hauling fishing nets and lines, hoisting masts, &c., was shown by Messrs. W. L. Mitchell & Co., of Kirkcaldy, N.B. This improved winch has been in use for over four years, during which more than 1,500 of them have been supplied, a fact which sufficiently testifies to their excellence. The machine is light, compact, and portable, and the working gear being all enclosed within the casting forming the body, any danger of damaging the nets is avoided. By a simple plan the apparatus can be at once secured in its seat, or set to any required angle, and so arranged to haul from either side, and shipped or unshipped as desired without unscrewing any part.

Messrs. H. I. Edwards & Sons, of South Shields, exhibited a large steel life buoy of peculiar construction, in the form of a pear, 7½ ft. high, and 8 ft. extreme diameter. It weighs about 16 cwt., is properly fitted with seats, and will accommodate 16 persons. It also has four automatic air valves which will admit air sufficient for 22 persons, when all other parts of the buoy are closed. Below the deck and seats are places constructed to hold provisions and water, and three oars, each 14 ft. long and jointed for convenience of stowage, are furnished for propelling and steering. The buoy is intended to be seated on the ship's deck or bridge, in a cap fixed to the vessel, and lashed down with four strong lashings by rings placed below each window, so that if necessary the fastenings may be cut from the inside. In case of ships sinking it can be floated from the deck, and in very heavy seas it could be launched over the side of the vessel, when it would be impossible to make use of an open boat.

George Angus & Co., of Newcastle-on-Tyne, exhibited a large miscellaneous selection of all kinds of leather and indiarubber goods for which they are well known, also asbestos in various forms as used for steam packings and other engineering purposes. Indiarubber and gutta percha products especially adapted for yachting, fishing, and life saving purposes, were also shown by Mr. H. A. Murton, of Newcastle,

Mr. Illius Augustus Timmis, of Great George Street, Westminister, sent one of his patent life and ship's boats, which we understand has been well received, not only by several of the superintendents of large shipping companies, but also by the Admiralty. This boat can be used for sailing and rowing, and requires no side davits or detaching oar, it is also reversible and cannot founder or sink. The top and bottom are both alike, with keels complete and each has a deck, and it is claimed by the inventor that its carrying capacity is greater than that of any boat of a similar size yet made, while its first cost is less. It is consrructed of steel of 13 B.W.G., and is provided with numerous bulkheads. A great number of automatic appliances for releasing ship's boats were shown, many being exceedingly simple and effective. Among them we noticed Leeman's patent automatic apparatus, which has been adopted by several large shipowners in Scotland and England, and which is not only most inexpensive in first cost, but at the same time most efficient, fulfilling all the requirements of the Board of Trade. It is claimed for this invention that it can be applied to every description of lowering gear, whether the usual block and falls, single pennants, or any of the numerous recently-designed appliances are used; that it cannot be released at an inopportune moment, and that it is as effective in action with the vessel at full speed as when stationary.

Mr. Chambers, of Edinburgh contributed an object which was inspected with peculiar interest by fishermen. We refer to a small anchor known as the "Devil," which, suspended from the bows of Belgian trawlers for the purpose of ploughing through English fishermen's herring nets, has often caused much serious damage by tearing them in pieces. This specimen was found entangled in the nets of the fishing dandy *M. A. B.*, of Yarmouth, on December 1st, 1881.

A great number of models of lifeboats and numerous life-saving apparatus were sent by the Royal National Life-Boat Institution. Among them was a model of their Standard life-boat, as used off the coasts of the British Isles. This boat is thirty-three feet long and eight feet wide, and rows ten oars, double banked.

The Board of Trade exhibited a complete set of rocket life-saving apparatus, which visitors had an opportunity of witnessing in actual operation. A lighter was moored some distance off the shore in front of the Aquarium, and after one or two unsuccessful attempts a rope was thrown over it by the men of the Tynemouth Life Brigade. Communication being thus established, the jacket and lines were speedily got into operation, and a number of persons hauled from the lighter to the show.

Models of fishing vessels, crab and lobster pots, guns, fishing tackle, life buoys, folding life rafts and boats, and a host of other useful appliances, were shown in great profusion; while a beautiful set of specimens of models of fishes from the Buckland Museum, lent by the Science and Art Department, South Kensington, were effectively displayed in the ante-chamber first reached by the visitor in descending from the Winter Garden.

Among the novel and interesting exhibits which do not appear in the catalogue we may mention at Stand Sec. 2, No. 98, a Dual Engine, driving two concentric shafts fitted with right and left-handed propellers in opposite directions direct from the piston-rod without gear of any description; we described a similar Dual Engine in a previous number, in connection with the Naval Exhibition of this year at the Agricultural Hall. There is also one of the early forms of screw-steering apparatus—this consists of a hollow globe having an equatorial slot in which one pair of trunnions work, the others being held in the usual manner by an open jaw, forming a *fixed* axis, while those in the slot of the globe are free to move, giving great freedom, at the same time little vibration to the parts used; this is described on a card as the "Original Screw-Steering Apparatus, designed by the late Capt. Brydges, Royal Artillery (inventor of the Clinometer), in 1860, and fitted in a working steamship model six feet long." There seems from this not to be so much *novelty* in the universal joint shewn in connection with another screw-steering apparatus exhibited in the building.

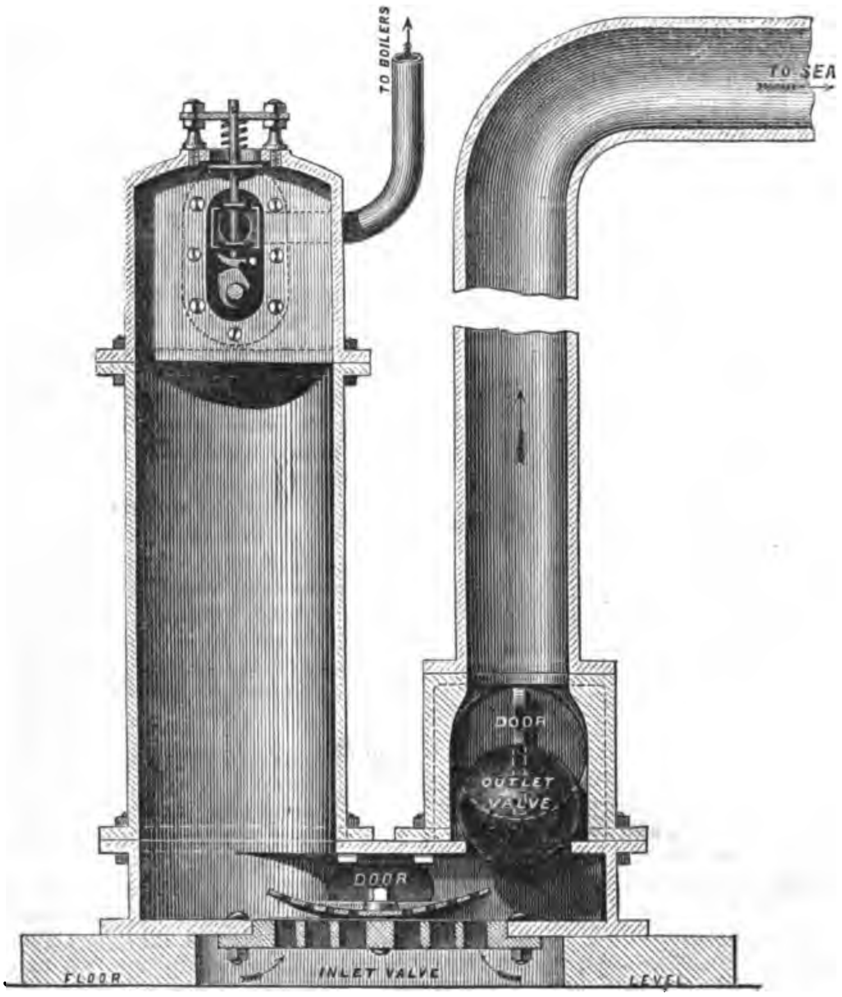
Asbestos is steadily forcing its way in the engineering market. The United Asbestos Company of London, as represented by their energetic northern agent, Mr. Mac Nay, of Middlesboro', made a good show at the Tynemouth Exhibition, of the many varieties of uses to which asbestos can be and is being applied. Asbestos packing for glands, and asbestos mill-boards for joints are now well known amongst the best found steam-ship companies, and to obtain satisfaction from the article, it is only necessary to make sure that it is pure. Asbestos boiler and pipe laggings naturally make the most perfect non-conductors of heat, and asbestos paint is now creating an excellent name for itself as a most durable acid and fire-resisting covering.

The long tough fibres of the United Asbestos Company's goods, make them so particularly satisfactory for packing purposes. There is probably a most extended future before this perfectly elastic and practically indestructible material.

The great need there is of a ship's pump which may be relied upon to work when it is wanted, however sudden the emergency, and which is not only capable of being put into operation in a few seconds, but is not liable to choke or get out of order when once started, is well recognized; but notwithstanding this, we are afraid there is little room for doubt that most of the pumps at present adopted on board ship are of such a character as to be almost entirely useless in cases of collision, the sudden springing of a leak, or other similar accidents.

It is chiefly with the view of supplying such an emergency pump that Mr. J. H. Kidd, of Westminster Buildings, Wrexham, is now drawing the attention of shipowners and others to his patent elevator, which is illustrated by a sectional engraving on this page, and the apparatus certainly appears to us to be not only a great improvement upon what has previously been proposed, but one which could be thoroughly well relied on in case of sudden emergency.

As will be seen from the engraving, the pump really consists of four simple castings, forming respectively the steam admission box, the pump barrel, and the suction and delivery valve chambers. The small amount of steam that is required is admitted through a balanced mitre valve, worked from a cam driven by a cord or strap from any engine or even by hand, and the only other moving parts about the machine are the inlet and outlet valves, which may be of any desired form. In the illustration the suction valve is shown as made on Kinghorn's Patent, and the delivery has a single india rubber ball, giving almost a full way passage.



KIDD'S PATENT ELEVATOR.

The elevator was originally designed for raising thick sewage matter, and has been most successfully applied at Watford for this purpose. The machine has been at work in the sewage tanks for twelve months, without once being opened for clearing, and was always ready to start the instant steam was turned on. This is a most severe trial, and there can be no doubt that a pump which can be relied on for such work is not likely to fail when called on to pump water from the bilge of a vessel.

Another very important feature in Kidd's elevator is the extremely small pressure and quantity of steam with which it can be worked, experiments showing that with steam at 8 pounds per square inch the water was lifted with violence some 17 feet, equivalent to a pressure of 7.478 pounds per square inch.

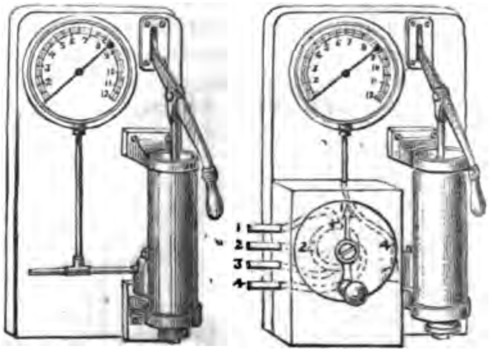
Altogether, we think Mr. Kidd's ingenious invention has a very extended application before it, both on account of its simplicity of construction, freedom from liability to derangement, low first cost, and above all, when on board ship its instant readiness to start.

A NEW arrangement of surface condenser, designed to give a hotter feed than is obtained with those of the usual construction, as well as to increase the efficiency of the cooling tubes, has recently been brought out by Mr. J. C. Spence, of Newcastle-on-Tyne.

This invention is illustrated by the accompanying engraving, which represents a transverse section taken through the condenser and air pump, and it will be seen that it differs from the condensers ordinarily in use, first, in making the exhaust steam enter at the bottom, and the cold circulating water at the top, and second, in arranging the tubes in vertical instead of diagonal lines. From observations made by the patentee, it was found that when the exhaust enters at the top, the temperature of the upper part of the condenser was no less than 20° higher than that of the lower, and that consequently a considerable amount of the cooling surface was employed, not in improving the vacuum but in chilling the feed water. To obviate this, the present plan was devised, and the bottom of the condenser is made the hottest part. The advantages claimed for this arrangement are: That the feed water being in immediate contact with the hottest vapour and the hottest part of the cooking surface, is at a higher temperature than was possible with the old design, and that by bringing in the cold water at the top of condenser, the currents of steam and water are in opposite directions, the hottest steam meeting the hottest water, and the coldest steam the coldest water, thus securing the maximum efficiency of cooling action with a given tube surface, and volume of water.

The experiments made by Mr. B. G. Nichol, at the Ouseburn Engines Works, in 1875, proved that the efficiency of the tube surface is increased as the velocity of water through them increases. Mr. Spence has deduced from this that the efficiency must also be increased by adding to the velocity of the steam on the outside, and to facilitate this flow, arranges the tubes in vertical lines instead of diagonal. We are not quite sure as to the correctness of the deduction, for as velocities are only relative, it would seem as if increasing that of the steam is equivalent to reducing the flow of water. However, actual practice is after all the best guide, and as Mr. Spence finds, and is prepared to guarantee a better vacuum and hotter feed in his condensers, with 10 per cent. less cooling surface than in the ordinary form, we think the invention will be well worth the attention of owners of steam ships, marine engineers, and others interested in surface condensation.

ANY sea-going captain will readily recognize the importance of being able at once, and privately, to know the depth of water in the hold or bilge, or in any compartment of it. It may be of equal interest and importance that he should know also the depth of water in the storage tanks, or the draught fore or aft. All these facts may be readily indicated in the captain's cabin or engine room, by means of one of Small's patent pneumatic hydrometers, as illustrated herewith. They are being very successfully introduced by Messrs. William Reid & Company, of 5, New London Street. The apparatus consists of a hand pump and gauge, indicating compression. By changing the tube, leading to the liquid required to be measured, with compressed air, a pressure equal to the load of water above the lower orifice of the immersed pipe, is communicated to the gauge, and when charged in this way the indications are continuous.



SMALL'S PATENT PNEUMATIC HYDROMETER.

If indications from several different receptacles are required, a suitable hand cock or valve is added, with suitable indicating numbers, so that the pump may be put in communication with any one of the receptacles as desired. The level of the water or liquid in that receptacle may then be at once ascertained by momentarily depressing the handle of the pump or charger.

Special air-tight unions are supplied for the connections, as this is a primary necessity for efficient action. The apparatus is conveniently mounted on a mahogany stand, and may be secured on any wall, at any distance from bilges or tanks. Several dials may be worked in different parts of the ship from a single apparatus. The whole arrangement is very simple and compact, and most ingenious.

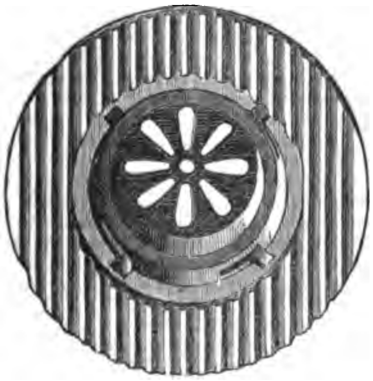
THE wear and tear upon all slide valves is so great as to form a constant item of repair, and this effect is constantly on the increase in marine engines, by reason of the considerable rise in the steam pressures now used.

The value of phosphor bronze for bearings where there is great pressure per square, and consequent tendency to wear is now established, but it has not yet been as generally applied to the construction of slide-valves as might be expected.

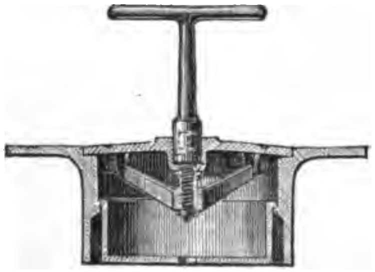
A pair of slide-valves taken out of a locomotive which had run 261,182 miles were exhibited by the Phosphor Bronze Company at the Tynemouth Exhibition, and were well worthy of attention as showing little signs of wear and tear. They were still capable of good work, as they were worn down to $\frac{5}{8}$ inch from 1 inch during $6\frac{1}{2}$ years working, and might be fairly estimated to last another 3 years.

Ordinary gun-metal valves under such circumstances rarely run more than eight months, consequently the comparison is infinitely to the advantage of phosphor bronze. This should be "tip" enough to marine engineers who want a good and lasting job.

THE necessity for securely fastening the deck covers of coal bunker, or other shoots, in a secure and water-tight manner, must be obvious to any captain or shipowner. The danger arising from insecure covers when heavy seas are shipped must be great. The covers may be easily unshipped where insecure by inadvertence, and serious accident may easily result. On the other hand again, it is advisable for convenience that the cover may be easily shipped, unshipped, and secured from the deck above.



McFarlane and Reid's improved cover which we illustrate herewith, as introduced by Messrs. Wm. Reid & Co., of 5, New London Street, fulfils these conditions admirably. The cover when dropped in place can be rigidly secured in place by screwing up a bolt by hand socket wrench. At the same time with a turn or so of the hand-wrench the cover is released and may be easily removed. This cover is very strong in construction, and cheap, and seems to be a long required desideratum for such a deck fitting.



MESSRS. COCHRAN & Co., Birkenhead, exhibited at the North East Coast Exhibition, a modification of their steam launch machinery, especially adapted by them for canal purposes, (see illustration page 209). The engine is inverted direct acting. The cylinder being 8 in. in diameter, and having a stroke of 10½ in. The boiler is Cochran's patent vertical multitubular, 3 ft. 3 in. in diameter, by 7 ft. 6 in. high ; it is suitable for a pressure of 80 lb. per square inch, and possesses 80 square feet of heating surface. For further description see page 180, October number. Messrs. COCHRAN & Co. obtained the highest award given for marine and land boilers, at the North East Coast Exhibition.

ON page 211, we illustrate an exceedingly compact and efficient fresh water condenser, intended chiefly for use on board ship, but which is aslo applicable to brewers' work and to general cooking and heating purposes.

The special feature in the "Acme Condenser," which is manufactured by Messrs. A. B. Fraser & Co., Fulton Iron Works, Liverpool, is the introduction of thin concentric corrugated rings of copper for the purpose of obtaining the greatest amount of condensing surface in the smallest space, with a greatly increased strength. The construction is clearly shown by Fig. 1, which is a section through the apparatus, and by Figs. 2, 3, 4 and 5, which give details of fixing the rings and tube connections. It will be seen that each pair of corrugated tubes is fixed top and bottom to end rings into which they are recessed and jointed with soft metal, the rings being drawn together by through bolts so as to prevent leakage. The inside of each pair of tubes is then put in connection with the steam supply by short pieces of pipe screwed to tube plates, the upper plate forming the bottom of the steam chest, and the lower one the top of the concensed water cistern. The steam enters at the top and draws in a little air with it so as to aërate the condensed water, then passes through the pipes to the inside of the corrugated cylinders, in which it is condensed and then drains to the bottom. Cooling water is admitted by a pipe at the lower end, and circulates upwards in the spaces left between each pair of cylinders, and finally out at the top. As an assurance against accident from undue pressure of steam or circulating water these condensers are fitted with spring safety valves, approved by the Board of Trade. All the materials and workmanship are of a superior character, and it is claimed for the apparatus that the quantity of pure fresh water produced is much greater than by any other condenser, while the weight and the space occupied is much less.

AWARDS TO THE EXHIBITORS AT THE NORTH EAST COAST EXHIBITION.

ON October 13th, the awards to exhibitors at the North-East Coast Exhibition, Tynemouth, were officially announced in the presence of a very large concourse of spectators assembled in the Winter Garden. The Right Hon. the Earl of Ravensworth (the president) occupied the chair, and among others present were :—Mr. Albert Grey, M.P., the Mayor of Newcastle (Ald. Angus), the Mayor of Sunderland (Mr. W. Wilson), Col. W. Boyd, Commander Johnson, R.N., Capt. Watson, Capt. Chapman, Capt. T. Smith, Major Lindsay, Rev. Mr. Hicks, Rev. T. Wheeler, Messrs. Bevis (Liverpool), J. M. Ridley, the Mayor of Tynemouth (Mr. Spence), F. C. Marshall, Jas. Laing, Percy Westmacott, Ald. R. Cail, Andrew Leslie, Horatio A. Adamson, W. M. Ward, H. J. Boolds, B. C. Browne, H. E. P. Adamson, P. J. Messent, G. R. Brewis, W. S. Daglish, J. Sibun, Alex. Taylor, W. G. Tate, Thomas Eccles, W. A. Charlton. John Rogerson, W. M. Roche, H. Cail, G. F. Shotton, Joseph Spence, J. F. Spence, Matthew Cay, — Henderson, H. H. Wake, Eicholtz (German Consul), Chas. Tate, J. H. Ingledew, C. B. Goldson, Geo. Fenwick, C. T. Gomosynski, Alex. Laing, Wm. Clarke, Jno. Brockat, Geo. Renwick (hon. secretary), B. Nichol, and Sidney Old (acting secretary).

Mr. Geo. Renwick, the hon. secretary, read the following report :—

The Committee feel that the present is a fitting opportunity to lay before the public a few interesting facts in connection with what is universally acknowledged to be one of the most successful exhibitions ever held. When the promoters first entertained the project of such an exhibition as this, they were in great doubt on the most vital point, viz., as to the amount of patronage they might expect to receive from the public. That doubt has now been removed by the public themselves in a most unexpected and gratifying manner. The number of visitors has far exceeded the Committee's most sanguine expectations, and this can be readily understood when it is stated that up to last evening the total number of persons who have attended the exhibition, has been as follows:—

Paid at gates	204,356
Season ticket-holders—Average, 500 daily—say	16,000
Exhibitors and attendants—Average, 500 daily—say	16,000
Free Admission to Life Brigadesmen, charity children, and others—say ...	1,000
Total attendances	287,356
Making an average daily attendance of about	7,500

The attendance for to-day and to-morrow may safely be estimated at 15,000, which will bring the total attendance up to a quarter of a million persons. The largest attendances were on the Saturdays of the 16th and 23rd of September. On each of these occasions over 20,000 persons visited the exhibition. The committee are glad to be in a position to announce that the receipts have been so satisfactory that they are enabled safely to predict a substantial surplus, after providing for all liabilities. The committee wish particularly to record their appreciation of the handsome manner in which their efforts have been supported by the guarantors, a list of whom will shortly be published. The committee also wish to mark their appreciation of, and to publicly announce their thanks for, the valuable assistance rendered by the North-Eastern Railway Company and the Tyne General Ferry Company, who by their liberal arrangements, have so largely contributed to the success of the exhibition. The committee feel they cannot close these remarks without expressing their sense of the deep obligations they are under to the enterprising firms who have exhibited their manufactures, most of which are of great variety and uniform excellence, and especially are they indebted to the various Electric and Gas Light Companies who have illuminated the buildings in such a successful manner. They also wish to record their thanks to the Royal National Lifeboat Institution and the Tyne Lifeboat Trustees, who have willingly lent their boats on various occasions; also to the members of the Tynemouth, South Shields, Sunderland, Blyth, and Seaton Sluice Life Brigades, for their interesting public drill practices. The committee is also largely indebted to the Lords of the Admiralty, the Trinity Brethren, Commissioners of Northern Lights, the Tyne and River Wear Commissioners, the P. and O. Steamship and other large shipping companies, for their interesting collections of models, &c. The committee are also indebted to their architect, Mr. Glover, and to Mr. Walter Scott, contractor, for the energy they have displayed and the successful manner in which they have adapted the buildings for the purposes of the Exhibition. And they trust that this, the first North-East Coast Exhibition, which has now been brought to such a successful close, will prove to be the forerunner of other similar exhibitions in the immediate future.

The Mayor of Newcastle moved, and the Town Clerk of Tynemouth seconded the adoption of the report.

Mr. Albert Grey, M.P., supported the motion. He thought no one who had spent an hour in that exhibition could help feeling what benefit it would have on matters on which it was exceedingly useful that a wide and accurate knowledge should be possessed by those who are responsible for the safe conduct of us over the seas, and that it had a national interest was evident from the fact that people from all parts of the country had appeared at that exhibition day after day, that they might learn and criticise carefully the various implements and objects of interest so effectively displayed. Tynemouth was only maintaining the high character it so worthily occupies as a district which had done more than any other part of the world to provide safety for those in peril on the sea.

Mr. F. C. Marshall, President of the Executive Committee, read the names of the judges in the different sections, and explained how the judges were appointed, and the basis upon which they had made their awards.

Lord Ravensworth said it would be a poor requital for the Executive Committee and all the staff to withhold at any rate some few words of congratulation and of praise upon the results of the exhibition. He thought the attendance and financial results were highly satisfactory; it had been a success from beginning to end. There were other causes for congratulation, and he would allude to but three; this Exhibition had furnished not only to England but to the world proofs of the extent, importance, and capability of the industry of the north-east district. Another cause of congratulation was that there had been no jealousy whatever exhibited on the part of any class of exhibitors or of the public; but all co-operated and worked for the common cause—the great success of the Exhibition; and he fully endorsed the hope that at no distant time a similar exhibition might be organised with similar success in a neighbouring port; and when the time came he was sure Tyneside would show the same kindly feeling, the same absence of jealousy, as had been shown in the present case. Last, but certainly not least, another subject of congratulation was the conduct of the thousands who had attended this Exhibition. There had been no dangerous crowding or pushing; but there had been thoroughly good conduct, and thoroughly discreet and appreciative knowledge and intellectual appreciation of the great objects which had been exhibited. This conveyed to his mind this most instructive and satisfactory lesson—give our masses the opportunity of healthful, innocent recreation and intellectual enlightenment, and they will largely avail themselves of it. In the midst of all the political hubbub, it had been a great satisfaction to quiet people to find a resort and a refuge like this. The mass had come and had seen what art, science, and industry can do in England; and it was a hopeful thing for commerce and industry that they know no politics. Great industrial communities such as we are don't ask Government for anything; we ask to be let alone; we ask for freedom and a fair field and no favour, and we are not afraid to meet the world. One of the great advantages of these exhibitions is that they bring together people of rival interests and of rival industries; and the trade of the world learns to do what it can do best. He thought the statistics prove the truth of what he said—that we in England ask to be let alone, and we are not afraid of the competition of the world. A great exhibition of this kind, instead of producing rivalry, produces friendship; it creates international relations which are lasting; and though in a few days these glittering walls would perhaps regain their pristine nakedness, the remembrance, the relations formed, and the new connections cemented by the Exhibition, would remain engraved upon the hearts of those who had attended it. He congratulated them with all his heart upon the success which had attended it. (Cheers.)

Mr. J. F. Spence and Mr. John Rogerson seconded a vote of thanks to the various officials, and these gentlemen severally acknowledged the compliment.

Mr. Leslie having made a few remarks,

Mr. F. C. Marshall suggested that the time had come for another International Exhibition in London.

Three cheers were then given for Lord Ravensworth, and the proceedings terminated.

NAVAL ARCHITECTURE, SECTION I.

SALOON FITTINGS.—Walker and Emly, silver medal.

PATENT MOVING DRAWINGS.—Batchelor silver medals.

FISH FIN RUDDERS.—George Stavers, silver medals.

MARINE ENGINEERING, SECTION II.

MARINE AND STANDARD ENGINES.—W. C. Church and Co., slide valves, silver medal; H. Watson and Co., slide valve, bronze medal; Ross and Duncan, expanding yacht engines, diploma.

COMBINED ENGINES AND BOILERS.—Robey and Co., electric light engines, silver medal; J. Fowler and Co., silver medal; Tangye Brothers, bronze medal; Rose, Davis and Thompson, diploma.

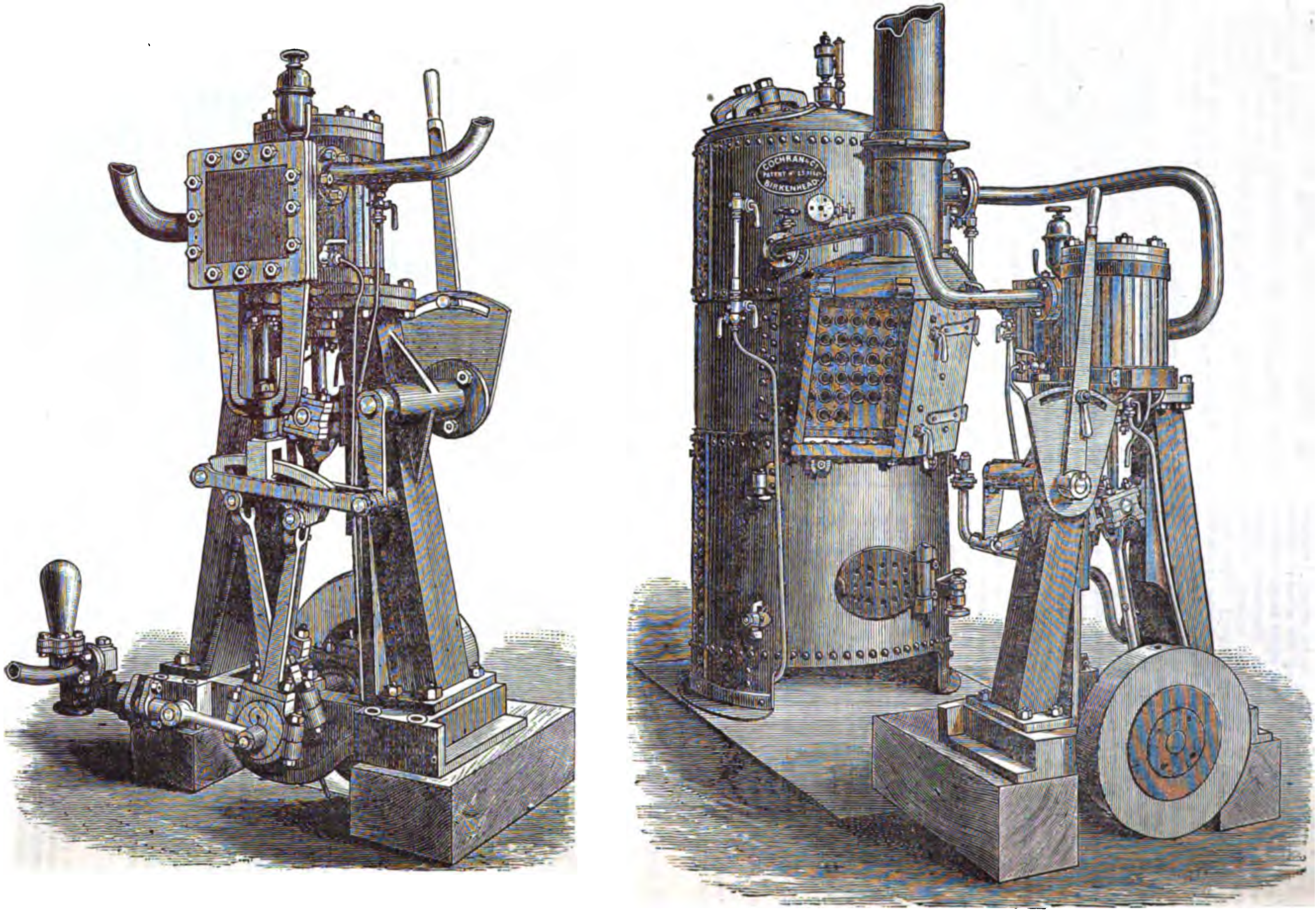
GAS AND AIR ENGINES.—Menzies and Blagburn, "Otto engine, silver medal; Andrews and Co., gas engine, bronze medal; S. Clayton and Co., gas engine, bronze medal; Caloric Engine Company, "Buckett" air engine, diploma; J. J. Butcher, gas engine, diploma.

AUXILIARY ENGINES, DONKEY PUMPS, &c.—H. Watson and Co., pumps, silver medal; W. H. Allen and Co., silver medal; Adair and Co., silver medal; J. and H. Gwynne, bronze medal; Polsometer Co., bronze medal; C. Burnett, coal cutter, J. H. Kidd, and Drysdale and Pierie, all diplomas.

STEAM AND HAND STEERING GEAR—Amos and Smith, silver medal; Donkin and Nichol, bronze medal; Harrison, Patent Company, bronze medal; J. Hastie and Co., diploma.

WINCHES AND CRANES.—Clarke, Chapman and Gurney, silver medal; Welford Brothers, bronze medal; J. Smith and Son, diploma.

WINDLASSES AND CAPSTANS.—Harfield and Co., silver medal Vulcan Iron Company, bronze medal; Napier and Co., bronze medal.


COCHRAN & Cº
BIRKENHEAD

Messrs. COCHRAN & Co.'s PATENT VERTICAL MULTITUBULAR BOILER AND ENGINE.

For description see page 207.

Dwarf Capstan.—S. Baxter and Co , bronze medal.

Marine and Land Boilers.—Cochrane and Co., bronze medal; I. Adamson and Co., diploma.

Furnaces and Flanged Boiler Plates.—Leeds Forge Company, furnaces, silver medal; Leeds Forge Company, flanged plates, diploma; J. T. Eltringham, South Shields, flange plates, diploma; John Broom and Co., Bowling Iron Company, and Clarke, Chapman, and Gurney, all diplomas.

Engine Room Telegraphs.—Chadburn and Sons, silver medal.

Patent Telegraph.—A. T. Dudgeon, silver medal.

Engine-room Governors.—Durham, Churchill and Co., silver and bronze medals.

Finished Steel Forgings.—Vickers, Sons and Co., silver medal; Palmer's Shipbuilding Company, for crank shaft, bronze medal; I. and W. Beardmore, forgings, bronze medal. Iron Forgings.—Hawkes, Crawshay and Co., silver medal; Darlington Forge Company, silver medal; Tyne Forge Company, bronze medal; R. Fletcher, diploma.

Steel Castings.—W. Jessop and Sons, silver medal; the Steel Company of Scotland, silver medal; J. Spencer and Son, silver medal; Stanners' Close Company, silver medal; Sutherst and Southern, bronze medal; Bowling Iron Company, bronze medal; J. Brown and Co., bronze medal.

Brass and Bronze Castings.—H. Wilson and Co., silver medal; Phosphor Bronze Company, silver medal; Whitley Partners, silver medal.

Finished Brass Work, Engine and Boiler Fittings.—J. Hopkinson and Co., silver medal; Harding and Sons, silver medal; Beck and Co., and J. Laing, bronze medals; Lampean and Theedam, diploma; Twyzell, Sons and Reid, North Shields, for lamps, diploma.

Best Exhibits of Steel Samples.—W. Spence and Co., W. Jessop and Sons, and J. Spencer and Sons, Seeholm and Beckstall, and Weardale Coal and Iron Company, silver medals; Hardy, Patent Pick Company, and Newcastle Spring Company, diplomas. Iron Samples.—Kirkstall Forge Company, silver medal.

Engineers' Tools.—I. W. Widdinson, R. Kell and Co., A. Humsden, and Mary Davison, silver medals; I. Heep and Co., and Hudswell, Clarke and Co., bronze medals; W. Reid and Co., diploma. Engineers' Stores, Packing, and Asbestos Goods.—Mr. Grundy, belting, silver medal; I. H. Bentham, indiarubber, bronze medal; Aubydrons' Patent Leather Company, and Glasgow Asbestos Company, diplomas.

Labour Saving Tools and Appliances, &c. J. Barrow, Anderson and Hunting, Scriven and Co., R. H. Tweddell, H. Pooley and Co., A. A. Ricaby (for Mettaline Co.'s Mettaline Bushes, Dundee), and Tannet and Walker, all silver medals; R. Rogers and Co., and W. Boaz, bronze medals; W. Askwith and Sely, Tormenthall and Co., diplomas.

Refrigerating Machines.—Douglas and Grant, silver medal; Galway, Bainbridge and Co.. bronze medal.

Distillers.—A. B. Frazer and Co., bronze medal; E. Perry, diploma.

Non-conducting Composition for Boilers, &c.—J. and G. Ross, D. Anderson, and R. Wells, bronze medals; R. B. Lyon, R. Wilson, and F. Leroy, diplomas.

Modes of the Treatment and Specimens of Processes.—J. E. Leardet, Clarke, Bunnet and Co., Martin's Patent Anchor Company, and B. and T. Massey, bronze medals; A. Leslie and Co., and G. W. Mansell, diplomas.

Iron, Brass, and Steel Tubes, &c.—Wilkes, Mapplebeck, A. and J. Stewart, and Anchor Tube Company, silver medals; Birmingham Tube Company, bronze medal; J. Spencer and Co., (Brunswick), diploma. Process of Manufacture.—Consett Iron Company, silver medal; J. C. Swan (exhibit); diploma. Piston Packages. A. Oldham, bronze medal.

Shafting Connections and Pulleys.—Douglas Brothers, for coupling, silver medal; Snowball and Co., diploma.

Smoke Preventing Appliances.—J. Fenwick, bronze medal; Mace and Brewster, diploma; Patent Rocking Bar Company, diploma.

Fog Signals.—Caloric Engine Company, for Holmes' Siren fog signal, silver medal.

Mooring Swivels, Chains, &c.—Hawks, Crawshay & Sons. silver medal.

Patent Anchor (Martin's) and (Tyzack's).—Hawks, Crawshay and Sons, bronze medal.

Steel Towlines, Hawsers, &c.—R. Hood, Haggie & Son, four silver medals.

Spring Compressor, Mace's patent.—J. J. Hopper, silver medal.

Oakum.—Anglo-American Rope Co., silver medal.

Wire Rope.—Dixon, Corbett and Spencer, diploma.

Manila Rope.—Dixon, Corbett and Spencer, bronze medal.

Lightning Conductor.—Dixon, Corbett and Spencer, silver medal.

Steel Hawser and Reel and Steel Halyards.—Hartlepool Ropery Co., silver medal.

Wire Hawser and Reel.—Gladholm and Robson, diploma.

Cast Steel Wire for Rope Making.—J. Shipman and Co., silver medal.

Sample Wire Rope.—J. H. Bentham and Co., bronze medal.

Manila.—J. H. Bentham and Co., diploma.

Wire Rigging Rope.—R. S. Navall and Co., bronze medal.

Automatic Nippers.—Bullivant and Co., diploma.

Flexible Steel Wire Rope.—Bullivant and Co., silver medal.

Patent Sea Anchor.—Bullivant and Co., diploma.

Double Acting Windlass Models.—J. Liardett and Co., silver medal.

Four Fluke Anchor.—J. Liardett and Co., silver medal.

Three Fluke Anchor.—J. Liardett and Co., silver medal.

Ropes and Cords.—Knowles and Knowles, Hull, silver medal.

Section IV.

Life Raft.—E. S. Copeman, silver medal; Timmis and Hodgson, silver medal.

Life Buoys.—Steedman and M'Alister, silver medal; J. Deighton and Co., bronze medal; W. Humble and Sons, bronze medal; James Linklater, diploma.

Patent Detaching Gear.—Sample and Ward, Blyth, silver medal; Hill and Clarke, silver medal; J. Leeman, bronze medal; Wilkinson and M'Gornel, diploma.

Patent Line-throwing Gear.—Low and Duff, silver medal.

Leak Stoppers.—J. W. Wood, diploma.

Lifeboat.—Baharie and Adamson, bronze medal.

Life-saving Appliance.—G. Angus and Co., diploma.

Life-saving Apparatus.—H. A. Murton, diploma.

Sections V. and VI.

Dredger.—Priestman Brothers, silver medal.

Hydraulic Excavator and Digger.—Bruce and Bathos, silver medal.

Depositing and Double-power Dock.—Clark and Stansfield, silver medal.

Stove.—Whitburn Coal Co., bronze medal.

Model Breakwater.—G. H. T. Beauminster, diploma.

Patent Pile Driver.—S. Owens and Co., diploma.

Miscellaneous.

Double Ram Ironclad.—J. Liardett and Co., honourable mention.

Engine and Wheelhouse Telegraphs.—Steamship and General Telegraph Co., silver medal.

Barometers.—Joseph Davis and Co., silver medal.

Porthole Ventilator.—Thomas Utley, silver medal.

Saloon Stove and Fire Place.—J. J. Simpson, silver medal.

Saloon Tile Panels.—J. J. Simpson, bronze medal.

Patent Locks and Oil Feeders.—Joseph Kaye, silver medal.

Sanitary Wire Mattress.—J. B. Rawcliffe, honourable mention.

Excelsior Ship's-Berth Mattress.—Charlton and Dugdale, silver medal.

Bedding.—Royal Blind Asylum, honourable mention.

Blocks.—Dyne and Ewens, silver medal.

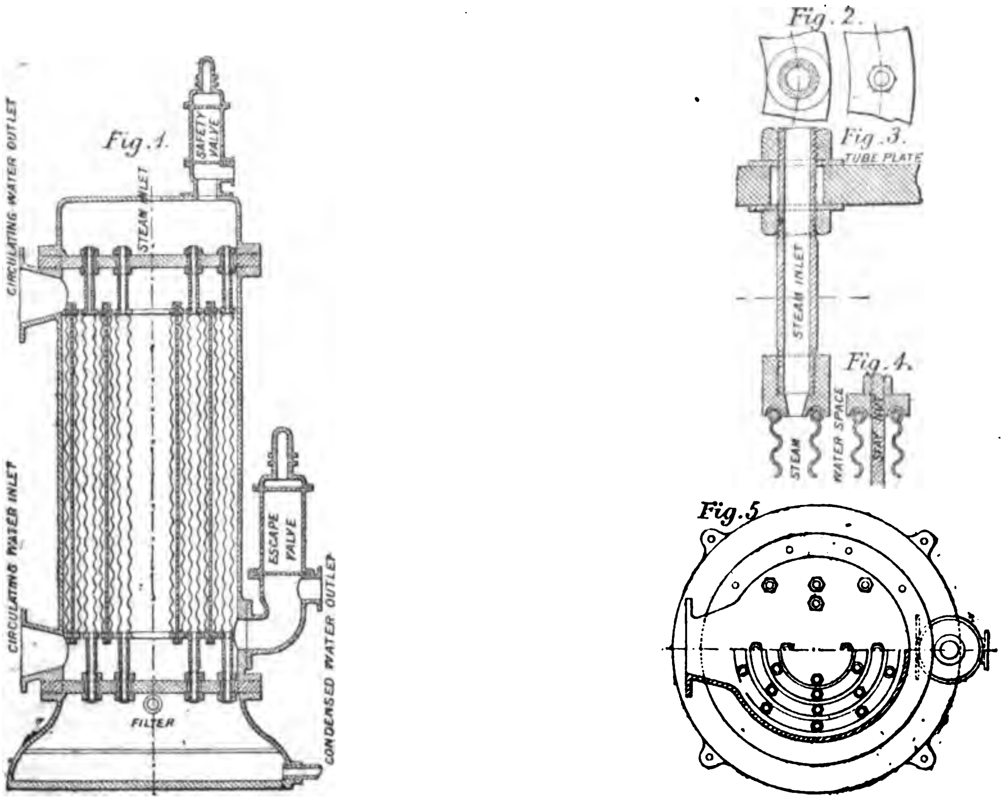
Pneumatic Bells and Indicators.—C. Ezindars, silver medal.

Cabin Fittings.—J. Coxon and Co., honourable mention.

Models.

James Bolt, Captain James, silver medal; ***Marlborough***, Captain Smith, silver medal; a Tugboat, John Brock, silver medal; Accommodation Ladder, R. Montgomery, bronze medal; Compass and Binnacle, J. Murray, silver medal; Helm Signals, G. Read Deal, silver medal; Steam-tug, J. Ridley, bronze medal; Sailing Ship, R. Donaldson, silver medal; Sailing Yacht, R. Gordon, silver medal; Atlantic Liners and Yachts, R. Ingram, bronze medal; Keyless Chronometer, J. S. Mattheson. silver medal; Blocks, Sheaves and Dead Eyes, W. Alexander, honourable mention; Showing Ships' Stability, Alexander Taylor, silver medal; Cooking Hearth, T. Procter and Son, honourable mention; Canvas and Twine, A. Mitchell and Co., bronze medal; Sounding Machine and Compass, Thomas Bassnett, Liverpool, silver medal; Air Pump, &c, R. Boyle and Son, silver medal; Lamps and Lanterns, Whitehead and Son, honourable mention; Brake for Steering Wheel, Atkinson and Phillipson, silver medal; Spirit Steering Compass, J. J. Wilson, silver medal; Steering Compass, &c, J. Morton, silver medal; Compass and Polaris combined, C. and W. Hutchinson, honourable mention; Self Registering Ship's Compass, Robert Pickwell, silver medal; Compass Corrector, T. L. Ainsley, bronze medal; Circle Chant, W. C. Bergen, silver medal; Signal Lamps, W. Harvie and Co., silver medal; Ships Chronometors, Reid and Sons, silver medal; Medicine Chests, R. T. Linton, honourable mention; Sail Cloth, Rutherford, Bros., silver medal; Engineers' and Ship Builders' Tools, Thomas Boston, silver medal.

About half-past 9 o'clock on Saturday evening, October 14th, the band of the 6th Durham Rifle Volunteers (South Shields), after having executed some delightful selections of music, left the orchestra, and Mr. Frank Marshall, the hon. secretary (Mr. Renwick), and several members of the executive committee ascended the platform for the purpose of formally closing the Exhibition. Mr. Marshall spoke of the great success which had attended the labours of the promoters, a great deal of which was due to the exertions of Mr. Renwick and Mr. Sidney Old, a gentleman who had worked morn, noon, and night for the good of the undertaking. They were also greatly indebted to Mr. Doeg for so successfully placing the exhibits, showing wonderful skill and taste. Mr. Renwick made a few remarks, in which he said that the exhibits brought together from this district were not second to any sent from either the Clyde, the Thames, or anywhere else. In response to loud cries for Mr. Sidney Old and Mr. Doeg, these gentlemen came forward and bowed their acknowledgments. Mr. Marshall, after thanking the exhibitors for the part they had taken in the Exhibition, and Messrs. Leggatt and Amers for the excellent music supplied, asked the audience, by way of closing the Exhibition, to join with Mr. Leggatt at the organ and sing the National Anthem, which they did, rising *en masse*, with heads uncovered. The proceedings then concluded.



Messrs. A. B. FRASER'S "ACME" CONDENSERS.—For description, see page 207.

A NEW ICE MAKING MACHINE.

On Friday the 13th of October, Professor Frankland, F.R.S., Dr. J. Hopkinson, F.R.S., and a number of gentlemen interested in the artificial production of cold, visited the works of the Aylesbury Dairy Company, Limited, at Bayswater, to witness the working of a new ice making and refrigerating machine, the invention of Mr. Windhausen, of Berlin. The apparatus is not only applicable to the production of large blocks of ice at, it is stated, about one-half the cost of what they can be made by the machines at present in use, but can be equally well adapted to the cooling of liquids without the intervention of brine. Its action depends upon the rapid evaporation induced by the introduction of water into an almost perfectly vacuous space, the vacuum being maintained by a compound air and vapour pump of novel construction. The only chemical is sulphuric acid, but as the same acid is used over and over again in a closed cycle, the same objections do not exist as if a fresh supply was continually required.

Mr. J. Hopkinson, who has critically examined the working of a machine in use in Berlin since 1880, is quite satisfied as to its durability, and as to the cheapness of production, and we therefore look forward with satisfaction to the introduction of this improved means of cooling into this country.

ELECTRICITY AND ITS MODERN DEVELOPMENTS, WITH SPECIAL REFERENCE TO MARINE ENGINEERING.

(Continued from page 115.

WE have referred to the use as a regulator of a wire constituting a branch or "shunt" to the main path of the current. Such a "shunt" forms an important expedient in almost every description of electrical apparatus. The principle is extremely simple. At some point in its path, the electric current is divided and runs in parallel or "multiple" channels for a certain distance. Confining ourselves to the case of two channels, we find as a rule, that the current in one wire is caused to perform a certain task—as *e.g.* lighting a lamp, or charging an accumulator—which varies and requires regulation. The current in the second wire varies in correspondence with the first according to a very easy law, and such variation is by some device, electrical or mechanical, induced automatically to correct the irregularities of the working current. If Q be the quantity of electricity flowing in the undivided circuit, and $q\,q'$, the quantities in the working current and in the shunt, then,

$$Q = q + q'.$$

It is obvious that for economic reasons, as little as possible of our supply of electricity should be diverted into the shunt. Now we know that $q = \frac{1}{\gamma}$ and $q' = \frac{1}{\gamma'}$, therefore to make q' small we must make γ' large. This, as we have seen in the case of the lamp, is effected by winding the controlling bobbins with a very long and thin wire. It will be observed we have made no mention of the electromotive force, E. This we are entitled to do, because we are considering not different currents but variations in the path of the same current. E is therefore for our own purpose constant, and may be taken as unity. E, the electromotive force or difference of potential between, say, the two terminals of a lamp, or of a dynamo machine, is indeed here, to use our old illustration, equivalent to the head of water due to difference of level. The head due thirty feet of fall is the same by whatever course or courses the water makes its way from the higher to the lower level. A parallel case to that we have been examining would be found in a river dividing for a portion of its journey into two branches and again reuniting. If one of the channels were dammed up or partially obstructed, the surplus water would be diverted into the other. If this, on rising above a certain level, were by its rise caused to remove the obstruction, as by opening a lock gate, we should have an exact parallel to the action of the Brush lamp.

Another example of the value of the "Shunt" deserves attention. It will have been doubtless noticed that, in the machine we have described, the current, after leaving the brushes, circulates through the field electro magnets before departing to the outer circuit, and the objection may naturally be started—In such an arrangement will not any increase in the resistance of the outer circuit cause a diminution in the current which, in its turn, will weaken the power of the electric magnets at a time when it is most wanted. And conversely, will not a diminution of resistance, as turning out one or more lamps, strengthen the field magnets when least wanted, and so waste the current? This result does, as a matter of fact, take place, and to correct it the "shunt" may be introduced. In some systems, as the Siemens, the machines are "shunt-wound"—that is, the current, after leaving the collecting brushes, is divided into two portions, one part circulating through the field magnets, the other traversing the outer circuit. As a consequence, when the external resistance increases or diminishes, more or less current is diverted to the field magnets, whose power to overcome the external resistance is thus increased or diminished exactly in proportion as more or less power is demanded. Various other regulating devices are employed, amongst them that shown on the extreme right of our plate of illustrations. This, Fig. 7, is engraved from a photograph of one of the first regulators made by the Brush Company, and that employed on the Dynamo used for the City of London Installation. This automatic governor, which we have not space to describe in minute detail, depends essentially on the principle used by Edison in his powdered carbon Telephone—viz., that the conductuiety of substances under pressure increases with the pressure. In the governor, as shown, four parallel columns are formed of thin squares of carbon, piled loosely one on top of another, the whole being kept in place by the framework of which the front plate has been removed in our drawing. These can be more or less pressed together by means of a lever suspended from a double plunger forming the cores of a couple of coils placed in the path of the field magnet current. If this increases the plunger and lever are raised, and the carbon blocks which are in the lamp circuit are compressed; the resistance is accordingly diminished, and a portion of the current is diverted from the field magnets, restoring them to their normal strength. The earliest application, of any practical importance, of the Arc Electric Light was to lighthouses. The great brilliancy and power of the new luminary would naturally cause it to be suggested for this purpose, while the minuteness of the space in which this intense illumination is produced afforded a facility for focussing which commended it to the lantern manufacturers. Indeed, if the opticians alone were to be considered or consulted, there would be few lighthouses without the electric light. Other points have, however, to be weighed, and some of these, to which we shall succinctly refer inthe sequel, have led many notable authorities to prefer gas or oil as illuminating agents. The discussion has been a long and able one, but it is beyond our scope to devote any considerable space to it. Neither does it lie within our province to describe the various arrangements of lenses, reflectors, and lanthorns that have been devised or are in use in our beacons. It may be taken for granted, as we have said, that, far from labouring under disabilities, electricity is peculiarly favoured by its adaptability to compression of the beam, projection, flashing, and the other optical phenomena involved. So interesting a study would demand separate treatment.

We shall first give a short historical *resume* of what has been done both at home and abroad in the way of illuminating our sea tracks by the Arc Lamp. [*]The first inauguration—on the sea—was from the South Foreland Lighthouse, on December 8th, 1858. This installation was the result of experiments made by the Trinity House at Blackwall, under the direction of Faraday, in the year 1857. The machine employed was a Holmes. This is a magnetic electric; that is, the field magnets are permanent magnets and not, as in most of the modern machines, electro-magnets. Two were employed in the lighthouse, and of these primitive machines the following particulars will prove interesting. "The dimensions over all were, length, 9ft. 3 in.; width, 5 ft. 6 in.; height, 9 ft. 6 in.; the weight being about 5½ tons. The machine contained sixty compound magnets, weighing forth-eight pounds each, mounted in three vertical planes. The helices (of the armature), one hundred and sixty in number, were arranged in two wheels of eighty to each wheel. The helices were driven at a speed of ninety revolutions per minute, by a non-condensing engine acting directly on the axle of the machine. The machine was provided with a roller commutator through which direct currents were produced. The power absorbed by each machine was about 2¾ horse-power." The lamp used was a Duborey in the focus of a large Fresnel lense.

This installation was followed in 1862 by one at the Dungeness Lighthouse, which remained in operation for thirteen years. By that time the Beacon had been left so far inward by the retreating sea, as no longer to mark the extreme point of the land, and it was superseded by a low lighthouse of a character purposely more or less temporary, owing to the frequent change of the coast line. The electric light apparatus, consisting of a "Holmes" machine, substantially as described, and a "Holmes" lamp, had become obsolete and was not re-erected.

In January, 1871, the electric light was inaugurated at Souter Point Beacon, about midway between Sunderland and Shields. A Holmes machine was again employed, but this time of an improved pattern, giving alternate current and requiring no commutator. A pair of these machines are driven with a pair of condensing Allen engines by Sir J, Whitworth. This apparatus was exhibited at the Paris Exhibition of 1867 from a scaffolding 120 ft. high.

The permanent installation at the South Foreland Lights followed. A dynamo-electric machine on the Siemens Wheatstone principle was constructed and tried by Dr. Tyndall and Sir James Douglas with great success as far as intensity of light was concerned, "but" and it is curious now to read the decision, "it was not considered safe to trust the machines to the severe ordeal of lighthouse service, and the magneto-electric machines of Holmes, though of inferior power, were again adopted."

In 1878, the Lizard received the benefit of the new luminary Great care was taken to render this installation in every particular a success, and it is at present the most perfect complete system around our coasts. The choice of a dynamo was preceded by most exhaustive trials at the South Foreland between various Holmes, Alliance, Gramme and Siemens machines. That of Siemens was selected, his small machines producing a light of close on 1,300

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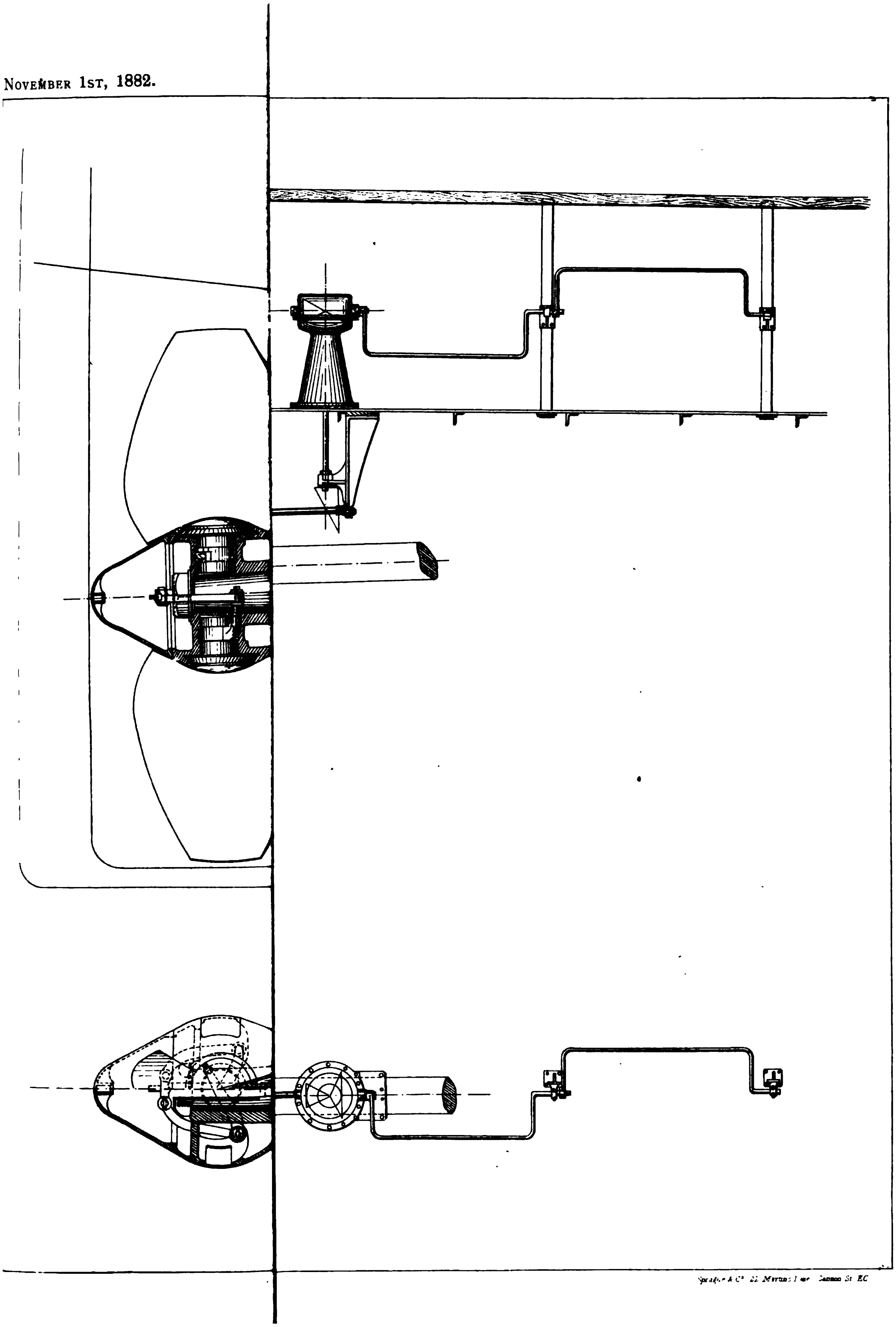
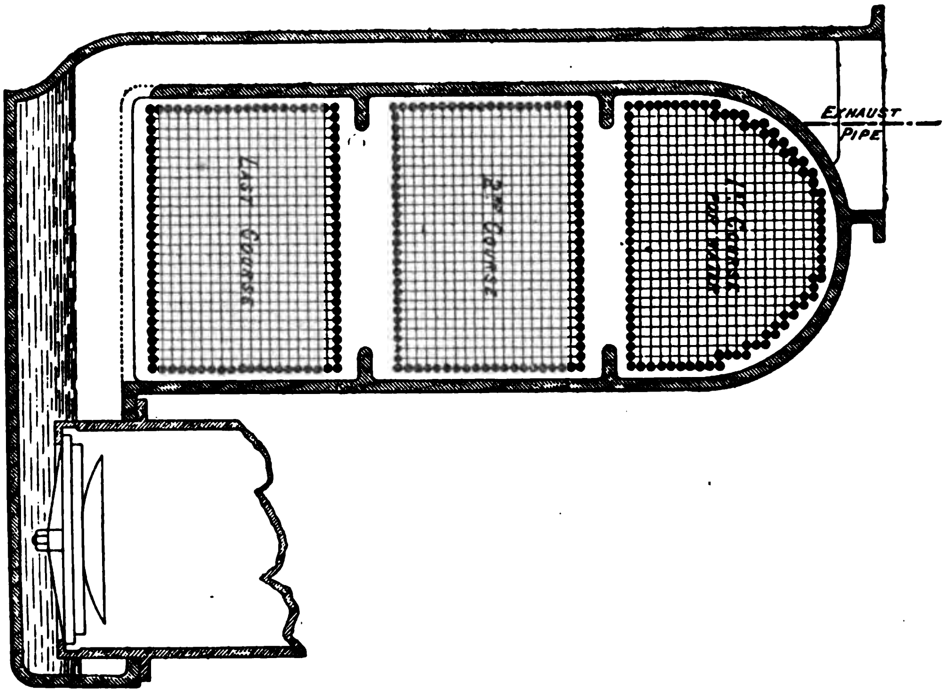
[*] The details of the application of the electric light to lighthouse illumination in this country are drawn chiefly from a paper read before the Institution of Civil Engineers, by Sir James N. Douglas, Engineer to the Trinity House Corporation.



Sprague & Co 22 Martins Lane Cannon St EC

standard candles per horse-power, a result nearly double that given Gramme and three times that of Helmes. Six large machines, each of a mean focal intensity of 3,620 candles, were erected, and these were driven by three 10 horse-power "Brown" caloric engines, the latter being also employed for sounding the large Siren fog signal. Sir James Douglas thus describes the mode of working these, a description which will interest sea-faring men by showing the extreme precautions taken against any possible failure of the guiding light. "These machines are arranged in three pairs, each pair being driven by a leather belt off a pulley on the fly wheel shaft of the caloric engines, the speed of the engines being sixty revolutions per minute, and that of the dynamo-electric machines 850. Each pair of dynamo-electric machines is fitted and bolted to the same cast-iron bed-plate, together with an intermediate pulley frame provided with two (driving and line) pulleys. The axle of each machine is connected to the axle of the pulley frame by a faced disc coupling and four bolts, and thus no unnecessary strain in driving is incurred at the axle or bearings of the dynamo. During clear weather the current from one machine is sent to each lantern (2); a second caloric engine with banked fire and its two dynamos being kept in readiness for immediate use. When the atmosphere is impaired, by rain, mist or snow, for the transmission of light, the second engine is started and the current from two machines coupled is sent to each tower, giving a mean intensity of each luminary in focus of about 8,250 candles. Whenever fog occurs the fog signal is sounded by one engine. With the occurrence of the fog between sunset and sunrise, and with the dynamos going at the time, the second engine is started for the fog signal, and the fire is lighted in the retort of the third engine; but if four of the dynamos happen to be at work at the time of the fog occurring, two are taken off the lights, the engine which was driving there is used for the fog signal, and the third engine is kept in readiness with a banked fire in case of accident to either of the other engines."

The arrangement of conductors for coupling up the second machine, if required, and for changing the lamps for renewal of carbons, are very similar to those we shall describe in connection with the French lighthouses. For comparison we give the figures showing the cost of the additional works and apparatus necessary for this installation, as well as of the annual outgoings.



SPENCE'S PATENT WATER CONDENSER.
For description see page 206.

Cost of Additions:—

Buildings and Lanterns	£7,636
Dynamo-Electric Machinery	3,800
Dioptric Apparatus	1,700
Total, exclusive of Siren (£1,800) ...	13,136

Annual Outgoings:—

Wages and allowances	£523	0	4
Coal, Coke, Carbons, Oil, and Stores ...	474	16	0
Carriage and Incidentals	45	0	0
Repairs and Renewals	493	0	0
Interest on the First Cost (£10,564), and Additions (£13,136) at 3½ per cent....	829	10	0
	2,365	6	4
The annual cost with Colza Oil was...	£1,016	7	11

The aggregate intensity of the flames of the old oil burners was 528 candles. The aggregate intensity for the two electric lights is:—

Minimum for	3,692 hours...	7,240 candles.
Maximum for	720 „	16,500 „
Mean for year of	4,412 „	8,751 „

"The intensity of the full power beam sent from each optical apparatus is, in the most illuminated plane, about 330,000 candles, being about 211½ times the intensity of the beam of each of the old caloptric lights, which was about 1,560 candles."

The cost would thus be for oil 55·29d. per hour.
„ for electricity 128·6d. „

or as 100 oil to 232·59 electric; but when we estimate the cost per candle power at the focus we get:—

Cost per candle per hour for oil 0·1047d.
„ „ „ „ electricity 0·0147d.

or as 100 oil to 14·04 electric.

France, however, is going far ahead of us in this matter. In addition to her large and magnificent modern lights at La Heue, Cape Grisney, Palmyre, and Plainer, plans have been prepared and sanctioned for encircling the whole French coast with Electric Beacons.

OUR ROYAL MARINE ENGINEERS AND ENGINE ROOM ARTIFICERS.

Continued from page 23.

IN our issues of January, February, and April of the present year, we have devoted an amount of space to review the duties and position of our royal marine engineers. As a great amount of agitation has been stirred up for some time past concerning the royal marine engineer department of our Navy to the effect that they were an underpaid and poorly recognized class of individuals considering their duties and responsibilities, we have endeavoured by giving a brief and clear account of their duties, their accommodation as officers, as improved and advanced of late years, and as compared with that of commissioned officers, together with other details, a good idea as to the status they occupy in common with other officers of rank and standing. At the termination of our last notice on this subject it was stated that a further notice would be given respecting the salaries of our royal marine engineers.

To give a fair idea of the current value awarded the engineer for his time and services, it will be necessary to notice the salaries awarded to commissioned officers of high rank and standing graduating to the junior grades, and compare the amounts paid to them with the sums received by the various grades of the engineering staff. In making this comparison it will undoubtedly be admitted that a captain of our Royal Navy is a high standard of comparison for an inspector of machinery, a commander for a chief engineer, a lieutenant for an engineer, and a sub-lieutenant for an assistant engineer.

A captain in full command of a sea-going ship receives a salary of from £410 12s. 6d. to £602 5s., according to seniority, together with a scale of command money from £191 12s. 6d. to £328 10s. per annum. A chief inspector of machinery receives a salary of £584, with an additional sum amounting to £54 15s. per annum. An inspector of machinery receives a salary of £511, with an additional sum of £54 15s. per annum.

A commander receives a salary of £365 with an additional sum when in sole command, varying from £45 12s. 6d. to £91 5s. per annum. A chief engineer receives a salary of from £237 5s. to £401 10s., he also receives from £18 5s. to £73 per annum, as an allowance for the engines he is in charge of according to their horse power—this sum is considerably increased in many cases. In addition to this a somewhat similar amount is received as an allowance for being in charge of stores.

A senior lieutenant receives a salary of £182 10s. and an allowance of £27 7s. 6d. in addition to full pay, but if in independent command of any ship or vessel, as is sometimes the case, his salary is increased to £200 15s. with an additional sum of command money ranging from £45 12s. 6d. to £68 8s. 9d. per annum.

An engineer receives a salary, ranging according to seniority, from £164 5s. to £200 15s. This is increased when in charge of any ships or vessel in commission from £18 5s. to £73 per annum, and a considerable increase is also granted for charge of stores.

A sub-lieutenant receives a salary of £91 5s. with allowances ranging from £27 7s. 6d. to £45 12s. 6d. per annum, if duly qualified to undertake special navigating duties.

An assistant engineer receives a salary from £109 10s. to £136 17s. 6d. per annum, with an additional annual sum of £18 5s. when in any charge.

From the foregoing it will be seen that the pay and emoluments received by the chief inspectors and inspectors of machinery of the Royal Navy is nearly equal to that of a captain.

The amount received by the chief engineers in salary and allowances is equal to that of a commander.

The amount received by engineers in salary and allowances exceeds that of a lieutenant, and the amount received by assistant engineers exceeds that of a sub-lieutenant.

It will therefore be clearly seen from the accounts concerning our royal marine engineers which we have given, that in cabin accommodation on board our men-of-war they are as well off as the higher grades of commissioned officers. As regards the officer's uniform it requires a skilled eye to discern the difference between an inspector of machinery and a captain, a chief engineer and a commander, &c., as compared above in rates of pay; and as regards pay it has been shown that in the comparative ranks given there is very little difference.

If then the pay and position of our royal marine engineer is not equivalent to the value of his services it must be concluded that the engineering branch of the service is a more important one than the fighting branch which comprises the navigating, seaman gunner, and marine artillery branches, &c., and prove that the captains, commanders, and others commissioned officers with all their knowledge of naval warfare, their seamanship, their command of men and ships are not so important an element in Her Majesty's Service as the engineer.

The rates of pay detailed above represents the amounts received by engineers engaged in active service. When not actively engaged they are still retained by the Government by the receipt of what is termed half pay. Under this system chief inspectors of machinery receive a salary of £328 10s., an inspector of machinery, £310 5s., chief engineers from £127 15s. to £292, engineers under three years' service £100 7s. 6d., engineers after three years' service £109 10s., assistant engineers under three years' service, £73, and assistant engineers after three years' service, £82 2s. 6d.

In addition to this should an engineer become disabled on account of ill health, accident, or by being wounded in action, he is allowed to retire for life on a scale of retired pay as follows:—

The retired pay for inspectors and chief inspectors of machinery, as well as chief engineers from 40 to 60 years of age, varies from £200 to £450 per annum. The maximum retired pay of an engineer varies from £130 to £150 per annum, and an assistant engineer £50 per annum. So from the time the royal marine engineer receives his appointment in Her Majesty's Service, providing his duties are properly carried out and his good character retained, he is provided for for life whether actively engaged or not, or if broken down by ill health, &c.

THE VENTILATION OF SHIPS.

No. 2.

AMONG the ew accounts of the vitiated air in ships, none of which appear to be satisfactory, one of the best is by Dr. Rattray, in a paper read upon the subject of this article before the Medico Chirurgical Society in 1872, and from which paper we are indebted to many of the following observations. It appears from his and other statements and experiments, that the foul air referred to consists of ammonia, sulphate of ammonium, sulphuretted hydrogen, and sometimes microscopic animal and vegetable organisms from the ship. And from the store, carbonic acid, and carbonic oxide, suphurous acid, sulphuretted hydrogen, ammonia, sulphide of ammonium, arising from the slow combustion of coal in the bunkers, and the burning of candles, oil, &c. Much injurious gas is emanated also from the warm oil in engine rooms, from cooking, and animal and vegetable odours, horses and other cattle on board, and other sources. Injurious effects also take place from suspended or floating substances in the air of the ship, as minute particles of wood, sail rope, metal, paint, whitewash, leather, bread, cotton wool, clothing, epithelium, gritty matter, fine dust from between the beams of lower decks, minute living acari, and particles of insects, &c.

We are told that it is proved by 150 analyses that carbonic acid is by far the most abundant and important impurity, and which, according to Pettenkoffer's test, which is generally relied upon as authentic by our more eminent hygiest, shows that throughout ships at all times, and in different degrees of crowding, they contain a vitiated atmosphere ranging from 4.20 to 33.71, and average as much as 14.60 volumes of carbonic acid per 1,000 volumes; the oxygen in the air being in consequence diminished to a corresponding degree. This contaminated atmosphere must appear very great and serious when we know that pure air only consists of four volumes of carbonic acid gas in 10,000.

This dangerous gas is most abundant where there is most crowding, namely, on the lower decks and middle tiers, and at meals, and by night. The proportion of such foul air is said to there vary from 4.20 to 28.85 volumes, a fact which shows that it is chiefly derived from respiration. From difficult and imperfect ventilation and direct contamination of air from combustion, the bilge, &c., it has been found that the lower parts of ships show from 9.34 to 26.37 volumes of carbonic acid gas, and in several cases even a still greater proportion, while the less crowded main deck tiers, on account of direct vitiation and diffusion, and being more open and considerably better ventilated than the former, contain from 4.20 to 16.32 volumes of this gas. It is stated that the crowded ward-room, pantry, indicated 19 volumes of carbonic acid gas, and that its confined and badly ventilated store-rooms, which were aired second hand from the lower deck, showed from 13·29 to 19·34 volumes of this gas, and the thrice contaminated air of the small cell or prison obtained from the storerooms, contained from 19·80 to 33·71 volumes of carbonic acid gas.

We are also informed that both officers and men breathe air nearly equally impure, and that the ward-room cabins average 14.49 volumes; main deck cabins 10.27 volumes; the well ventilated but crowded cadets' mess room 7.86 volumes; the compartment in which they study 15.42; and in rough weather when barred 27.61 volumes; their dormitory below, as much as 62 volumes per 1000 of the pure air alone fit for respiration, and much in excess of our worst ventilated barracks, prisons, and other public buildings which contains the greatest amount of vitiated air.

It is generally found that the whitewash with which the inside of ships is often painted is, after six weeks or two months, on the lower deck near the head of the sleepers, to be highly effervescent under acids, and almost entirely converted into carbonate.

The following important table to contrast the carbonic acid gas in the air of different parts of a ship, has been prepared by Dr. Rattray, and will, we feel convinced, be read with much interest.

		Number of Analyses made.	Volume of carbonic acid per 1000 of air at different times of the night and day, and different degrees of crowding.			
			Highest	Lowest.	Averages.	
Upper Tier.	Main deck.	10	16·3	7·83	11·4	11·71
	Half deck.	1	13·99	13·99	13·99	
	Study.	3	27·61	5·59	15·42	
	Mess room.	2	11·53	4·20	7·86	
	Main deck Cabins.	2	12·05	8·49	10·27	
Middle Tier.	Lower deck.	47	28·06	4·20	16·33	15·86
	Steerage.	1	10·58	10·58	10·58	
	Ward room.	4	2[illegible]·14	7·70	17·82	
	Chest (cadets sleeping) room.	7	28·85	10·01	15·62	
	Ward room and steerage cabins.	2	16·23	12·76	14·49	
	Do. pantry.	1	19·34	19·34	19·34	
Lowest Tier.	Stoke hole.	15	26·37	4·54	14·24	15·34
	Engine room	2	13·99	12·67	13·33	
	Screw alley.	2	11·21	9·34	10·22	
	Cork pit.	2	14·96	14·72	14·84	
	Store room.	3	19·34	13·29	16·42	
	Cells.	7	33·71	19·89	23·01	
	Total	111	...	...	...	
	Highest	...	33·71	...	...	
	Lowest	...	...	4·20	...	
	Average	...	...	...	14.60	

It appears, also, that from 150 analyses of the air between decks during the voyage to the Cape and back of H. M. frigate *Bristol*, a wooden training ship for cadets, and principally ventilated with wind-sails, and which vessel contained an average sleeping space of 105 to 222 cubic feet for the crew, and from 242 to 506 for the cadets, it was ascertained that the vitiated air was terribly poisonous, as the average proportion of carbonic acid gas found was no less than 16.4 volumes per 1,000 of pure air, and which ranged from 4.2 up to 33.71 volumes in the most crowded parts of the ship.

After carbonic acid gas the by far the most dangerous gaseous impurity in ship air is sulphuretted hydrogen, and which mostly emanates from human and other animal excretions, leakage of rotton timber, the decomposition of sulphates in salt water. So deadly is this gas that it has been declared by toxicologists and others to be the most deadly in existence. Both the late Dr. A. S. Taylor and Sir Robert Christison, Bart., M.D., have made strong statements concerning its awful poisonous properties in small proportions, and several instances are recorded where deaths have been instantaneously caused by inhaling it in small quantities from decomposed animal and vegetable substances. Much important imformation has been communicated respecting the poisonous changes produced in the blood by sulphuretted hydrogen gas by the critical investigations made on this subject by Hoppe-Seyler, Kaufmann, Rosenthal, Diakonow, Preyer, and other celebrated toxicologists. This deadly gas is found to be most abundant below, particularly in the middle and lower decks, where the men are berthed.

Again, according to the authority of Mr. Reed, whose views upon the ventilation of ships are very important in some particulars, it is stated that in many careful observations which have been taken at all hours of the night, in different ships, and under widely different circumstances, it will be noticed that when the lower deck is crowded with the usual number of men, for whom it is provided, and the ports shut, that they do not enjoy a proper or refreshing sleep, and he very properly adds that "even when one-third or one-half of the men are not in their hammocks, still the space allowed for each does not at ordinary temperatures, and with no special arrangements for ventilation, allow any adequate supply of air. In a few minutes in general after the men retire to rest the atmosphere around them becomes saturated with moisture, and largely charged with carbonic acid and animal exhalations even, then it is almost insupportably offensive to the majority of individuals accustomed to a better atmosphere, who place their head for a short time between the hammocks. It is perhaps not too much to affirm that the premature old age which appears to creep insiduously upon the sailor who sleeps where such an atmosphere prevails, arises more from this cause than all the other hardships to which he is exposed, particularly when it is recollected that his natural sleep is broken by unequal watches, and that he is not unfrequently called upon to pass from enervating and overheated atmosphere to encounter all the severities of the storm and the coldness of the midnight air. . . . The bad effect of those extreme transitions are to many more injurious than an oppressive atmosphere."

These strong and true remarks are quite applicable to an immense number of ships at the present day, and we quite agree with the statement by the *Lancet*, that naval architects are still very careless as a rule, respecting the ventilation of even the best class of ships built expressly for first-class passengers, and that this neglect is productive of much mortality, and injury and danger to health. The subject is, however, now undergoing much anxious enquiry by scientific men, the Admiralty, and the Board of Trade, and we trust on this account, and the communications of important facts concerning ship ventilation, that good results will follow. In our next number we will mention many additional facts respecting the ill-consequences that have resulted and are likely to follow from by badly ventilated ships, and then point out the means whereby the grievance may be economically and satisfactorily remedied.

(*To be continued.*)

THE CONDENSATION OF SALT WATER AT ALEXANDRIA.

Owing to the peculiar nature of the fresh water supply in Egypt, and to the fact that it lay practically at the mercy of the enemy, extensive preparations had to be made for the condensing of salt water, in order that there might be no danger of a serious want of this necessity of life. We are enabled to give a memorandum which was drawn up by an officer of the fleet on the subject of the arrangements which were made at Alexandria for condensing and supplying the condensed water. It is as follows:—

"After a careful examination with Mr. Foreman, chief engineer of the *Bittern*, assisted by the best local authority, of the resources of Alexandria, it was decided to fit the large premises of the Alexandria Cotton Pressing Company at Gabari as the principal condensing establishment, with another in the Arsenal, utilizing there the boilers of some engines which had been employed for pumping out a dock now filled with water and no longer used. The Gabari establishment was very conveniently situated, as all the troops landed there, and close round it were grouped barracks, the head-quarters of the Transport, the Commissariat, and Military Hospital. It was about 300 yards from the harbour and about 35 ft. above the water level. The premises were very large, with broad streets on two sides and a courtyard. It was two stories high and had a convenient fitting shop in the building. There were five large boilers in excellent condition. To enable these premises to be adapted to their new purpose the following work was done:—Four out of the five boilers were disconnected from the engines, and pipes were fitted to conduct the steam to two iron reservoirs already on the premises, which were fitted as condensers. The fifth boiler was reserved for working the lathes, &c., in the fitting shop, and the auxiliary engines, feeds, &c. These condensers were iron tanks of about ten tons capacity. In one of these was placed three coils of 1-inch iron piping, 600 ft. in total length; in the other two coils of 2-inch piping, total length 240 ft. The circulating water was thrown up from the harbour by a 4-inch centrifugal pump worked by an 8-horse power portable driving engine, 2½-inch iron gas piping being used. On trial it was found that owing to the length of piping the centrifugal was unable to throw a sufficient quantity of water to the required height on upper floor of the building. It was accordingly led into a tank placed in a cellar, and a donkey engine, already there, was utilized to throw the water the required height. This was found to answer; a sufficient quantity of circulating water (about 40 tons an hour) being obtained. And the condensers were able to supply 30 and 40 tons of water respectively per diem, the larger piping giving the best results. It was found, however, that the boilers were capable of generating a larger quantity of steam, and accordingly, a third condenser was built of wood by the carpenters of the fleet, and in it were placed two coils of 2-inch piping of a total length of 416 ft. An independent supply of circulating water was obtained by means of a 6 in. centrifugal pump driven by an 8-horse power portable engine and 4 in. iron piping. An ample supply of circulating water was thus obtained from near the locks at the entrance of the canal, a distance of 220 yards. This condenser was never used to its utmost capacity, which was certainly at least 60 tons per diem. For storing the water three large open wooden tanks were made by the carpenters of the fleet, each capable of holding 12 tons of water and ten old wooded tanks that had been used in Abyssinia, of a capacity of about 4½ tons each, were sent from Malta. These were raised well above the floor of the building and connected with each other. Pipes were led from the condensers along the floor over head and discharged their water into a zinc-lined box thickly perforated and placed over one of the open tanks; the water while falling into the reservoir was thus broken up, cooled, and aërated. These reservoirs (containing an aggregate of about 80 tons of water) were connected by pipes with two large iron troughs outside the building, placed high enough to discharge the water into the military water carts, and were fitted so that 12 or 13 carts could be filled at the same time. Pipes were also led from the reservoir to fill wooden horse troughs, placed round the courtyard before mentioned, at which about 40 horses could be watered together. Some iron tanks of a total capacity of 22 tons, were also placed on the ground floor in immediate communication with the condensers, from which the men were to draw their drinking, cooking, &c., water in kettles. The work in this establishment was in charge of Mr. Welch, engineer of the *Helicon*, and the great success attained was largely due to his great zeal, ability, and intelligence. It was an exceptionally economical condenser, nine tons of water being made for a ton of coal, without including the driving engines (including everything, about eight tons of water was made per ton of coals). An entirely different plan was carried out at the arsenal dock condenser. In this case the boilers were about 25 yards from the dock which was used as a condenser, the steam being conveyed thither from the boilers by three 3 in. iron pipes (a single large pipe would have been better probably, but it could not at the time be obtained). Two donkeys had to be fitted for feeding the boilers, each having a 3½ in. plunger and 7 in. stroke. The arrangements for condensing the steam were as follow:—On reaching the dock the steam was again subdivided, three 1½ in. pipes being fitted to take the steam from each of the three main steam pipes. These smaller pipes were bent, and laid about, on an average, 5 ft. under water along the dock and raised at the other end so as to discharge their water into an iron receiving tank placed at the side of the dock, the total length of piping being 900 ft. This receiving tank was placed in connection with five other iron tanks, fitted with cocks for drawing off the water and connected with large iron troughs for filling carts ten at a time, as at Gabari, an overflow pipe being led into an iron lighter capable of holding about 120 tons of water, and fitted as a tank At first three coils instead of nine separate pipes were tried, but the result was disappointing. Only about 45 tons of water could be made per diem, and a considerable pressure of steam was required, which was objectionable, as the boilers were old, and no one could be found who knew anything about them. The alteration above described increased the output of water to about 70 tons and required only a very low pressure. It was never an economical condenser, 5½ tons of water only being made to a ton of coal; but, on the other hand, having no auxiliary or driving engines, less supervision was required. The large consumption of coal was due entirely to the boilers being of very old pattern. This establishment and all the work done there was under the personal superintendence of Mr. Swinney, engineer of the *Tamar*, and I cannot speak too highly of his services there. The Malta condenser was put together on the Arsenal jetty by Mr. Rigler, engineer of the *Invincible*. It requires careful watching and is fairly economical, seven tons of water being made with one ton of coal. Being quite complete in itself it would be most useful in any out-of-the-way place. It took about a week to remove it from the vessel that brought it and to get it erected and in working order. The arrangement for supply of the water was similar to that at the Arsenal Dock condenser. A vessel that had been originally chartered to take refugees to Malta, called the *Maulkins Tower*, being available, I had her surface condensers fitted for distilling water for issue, and placed her in a convenient position alongside a wharf near the native quarter. She has ballast tanks capable of holding over 300 tons of water. These were thoroughly cleaned and then filled with fresh water, which could be supplied by her pumps directly into tanks alongside. She was capable of distilling at least 70 tons of water per diem at a cost of a ton of coal for about 6½ to 7 tons of water. She was originally intended to supply the native population, but as they never felt the scarcity of water she was very useful in completing the transports and supplying the troops stationed at Meks. I made arrangements with His Highness the Khedive that his splendid yacht, the *Mahroussa*, should supply with her surface condensers all the water required at the Palace, where a very large number of people (2,500) were constantly maintained. The yacht, with her numerous boilers, was capable of turning out 250 tons a day, but it was not intended to draw on her for the public unless required by urgent necessity. The sum of all these arrangements, it will be seen, provided for a supply of fresh water of 330 tons per diem, or nearly 70,000 gallons, without counting the Khedive's yacht. This would have fully met the requirements of the population estimated to be in Alexandria when the scarcity of water seemed imminent. Mr. Felix Foreman, chief engineer of the *Bittern*, was in charge of the whole work. He was untiring in his exertions and showed remarkable ingenuity in his arrangements. The work was entirely performed by the artificers of the fleet, except in the last few days, when some assistance was given by the men of the Royal Engineers. The supply of water to the troops commenced about a fortnight after beginning operations, and was continued for between six and seven weeks, and has not yet quite ceased. Had it been required sooner we were ready to commence the supply to a limited extent at least a week earlier.—September 22."—*The Times*.

ASBESTOS PATENT FIRE-PROOF PAINT.

IT must be quite clear to all persons of ordinary intelligence that any additional appreciable means of protecting buildings and ships, and parts of such, from total or serious partial loss by fire must be a great public benefit.

Now, although during the last quarter of a century several important, and a few ingenious, contrivances have been made for this purpose, it was not until a few months ago that a process was discovered whereby this and other kinds of property can be absolutely protected from destruction by fire. Such new invention, (which, without exaggeration, may be said to excel all other means that have been designed to render the property referred to indestructible by fire), is the Asbestos Patent Fire-Proof Paint, made from Asbestos, a mineral substance found in the crevices of rocks in Northern Italy. It is manufactured by the United Asbestos Company, Limited, whose chief offices are at 161, Queen Victoria Street, London, E.C., and the Chairman of the Company is Mr. James Allport, late General Manager of the Midland Railway.

Public experiments of the fire-resisting properties of this Asbestos paint have been made at several places besides on the premises of the Company, where we recently witnessed some of their tests. Among these additional places are the grounds of the Crystal Palace, at Sydenham; the grounds adjoining the Shakespeare Memorial Theatre, Stratford-on-Avon; and at the Fire Brigade and Police Station yards at Manchester, Liverpool, Glasgow, and Birmingham; and on a piece of vacant ground in Whitehall Place, adjoining the Thames Embankment.

The tests have been observed and highly appreciated by many scientific official and other gentlemen, who are much interested and concerned in further protecting life and property from destruction or injury by fire, including Sir J. M'Garel Hogg, Bart., M.P., Chairman of the Metropolitan Board of Works, Captain Shaw, Chief of the Metropolitan Fire Brigade. Mr. Shepherd, Chief Officer of the Building Acts Committee of the Metropolitan Board of Works, Mr. Ponsonby Fane, as representative of the Lord Chamberlain, the Lord Mayor of London, and the Lord Provost of Glasgow, the Directors of the Crystal Palace Company, the Superintendents of the Manchester, Salford, Bolton, Liverpool, and Birmingham Fire Brigades, the Chief Constables of Manchester, Liverpool and Birmingham, representatives of several leading London and Provincial theatres and music halls, a host of scientific chemists and engineers, and representatives of leading London and Provincial newspapers.

One of the more important of these experiments was made in the presence of a large party of gentlemen at the Crystal Palace. The first trial was made by vertically suspending a sheet of gauze between two supports with the word "Asbestos" painted across the middle of this sheet, with the new paint in letters of about two feet high. A light was then applied to it at its base, when the gauze, except that portion of it containing the painted letters, which was uninjured, was immediately destroyed by the fire. The second test was by placing several pieces of wood painted with Asbestos paint, and others unpainted in a fierce fire. The latter pieces at once caught fire and were quickly consumed with a loud snapping noise, while the former wooden blocks resisted the fire for a long time without any perceptive injurious effect to them, and when they were taken from the fire the coating of paint peeled off and the wood under it was merely charred or blackened. In the third and principal experiment two model theatres made of wood were used, and the front of which was open to the spectators so that they were able to see the scenery, flies, rope, or other parts of such. One of these structures was coated all over with the Asbestos paint, while the other and its interior materials were unpainted. Shavings, well saturated with petroleum, were placed underneath the staging of each model theatre, which was raised about three feet from the ground by stone supports at the angles; and, upon a light being applied to such shavings under both structures simultaneously, the unpainted theatre quickly caught fire, and after blazing and crackling very fiercely for about ten minutes its supports were burnt through, and it became a pile of burning ruins. The protected structure, however, well resisted the effects of the fire to the last, notwithstanding several lots of petroleum-soaked shavings had been applied to it. The woodwork, canvas, and ropes were merely blackened and not charred. Two small open timber sheds, one of which was painted and the other not coated with the Asbestos paint, were similarly tested, with equally satisfactory results. Two larger model theatres, each containing three tons and a half of wood, were subjected to the same test as the previous ones were. In this further experiment shavings saturated with petroleum were placed in the roof of each structure, and which were lighted at the same time. In ten minutes the flames had so burnt the roof of the one unprotected by the Asbestos paint that it fell instantly afterwards, and the whole model theatre was a heap of ashes in half an hour; while the structure which had three coats of Asbestos paint applied to it was not damaged after several supplies of lighted shavings soaked in petroleum had been applied to it, and the only injury done to such after it had been fired for about three-quarters of an hour was the burning of a small part of its roof. No part of the stage was even touched by the excessive heat of the highly-inflammable shavings, while the Asbestos cloth, of a thin material of a muslin-like kind, before which some shavings burnt for a long time, was almost unaffected by the blaze. One of the wooden supports which had resisted the effects of the fire the whole time was taken from its place at the back of the stage at the end of the experiment, and was found to be undamaged, a few blisters being the only evidence of the intense heat to which it had been subjected. These and other experiments conclusively prove that this Asbestos paint is quite fire-proof, and, if properly applied, will save a house or other buildings from destruction by fire.

Abestos paint has other important merits in addition to its fire resisting powers which strongly recommend it for adoption instead of the ordinary paints. We are informed by the manufacturers that it flows readily, quickly dries, and is easily applied, and its durability has been proved by chemical and other tests. It is also highly valuable on account of its insolubility and great resisting power to the action of gases, acids, and weather, and the fumes of sulphuretted hydrogen and ammonia produced from steam and smoke. Moreover, ornamentation, colour, and gilding can also be applied without affecting its usefulness.

As to its cheapness we are informed by the manufacturers that its price compares favourably with that of ordinary paints, and that its weight is 22½ per cent. lighter, measure for measure, and it has a better body and covering powers than ordinary paint.

As the Abestos paint is both weather and fire-proof, it is particularly suitable for coating the funnels, outsides, and in many of the interior parts of ships, as ordinary paint soon peels off or becomes almost worthless for these purposes.

Abestos paint may also with great advantage be applied to ships, boats, lighthouses, and buoys of various kinds, which require a very strong adhesive paint to resist the severe action of the weather. For these uses, we are informed that a specially durable article is expressly made. The funnels and outsides of ships suffer so much from the heat and weather that it is extremely important that a paint possessing such qualities as that we have described should be used for these purposes. As affecting the preservation of life and property in ships it is of even greater importance that the fire-proof paint should be brought into requisition for coating the whole of the interior woodwork of all new vessels, and for repainting the woodwork of old ones under repair, and we hope, in the shipping interest, to see it universally adopted.

THE "RAINBOW" WATER EJECTOR.

A SIMPLE and effective bilge pump is a great necessity for all vessels, large or small. Not only should a good bilge pump be capable of lifting a large quantity of water with little steam, but above all should not be easily choked by grit or waste, or rusted up by standing still. This is too frequently the case with all ordinary bilge pumps of the plunger or bucket type, and there is evidently much room for improvement. Much attention has also been lately directed to the great value of powerful bilge pumps, worked independent of the engine in case of a sudden leak. The great obstacle to the adoption of sufficient bilge-pump power to meet the necessities of a leak, is undoubtedly the expense of powerful independent donkey bilge pumps.

The "Rainbow" ejector is an invention which, like all good ones, is startlingly simple, and seems specially designed to meet all these particular features for a good bilge pump.

There are no valves or moving parts in the ejector, as it is caused to operate simply by the admission of a jet of steam, owing to the special construction of its parts. The water that it delivers for its price and size is something amazing, the 2-in. costing only £6 6s., raising 3,000 gallons per hour. A small vessel, fitted with two or three such bilge pumps of larger size might, bid defiance to any ordinary leak, and their action would be quite independent of the engine.

The "Rainbow" is always reliable for immediate starting, as there is nothing to rust up, and the steam-cock has only to be turned on to immediately raise and deliver the water. It requires no oil, packing, or attention, and any grit, stones, or obstruction that will enter the suction pipe will pass the whole apparatus, so that there is no fear of its choking.

This ejector is being introduced by Messrs. Harding Cocks & Co., of 29, Jewry Street, Fenchurch Street, E.C., who have had considerable experience of its efficiency. We cannot but concur in the opinion that we see is given by many users, that its simplicity deserves every success.

Literary Announcements.—A new edition, re-written and enlarged, of Mr. Lowis D'A. Jackson's *Hydraulic Manual*, consisting of Working Tables and Explanatory Text, is announced for early publication by Messrs. Crosby Lockwood & Co, London. The same publishers also promise immediately a new and enlarged edition of Mr. Michael Reynolds' *Stationary Engine Driving*, a Practical Manual for Engineers in charge of Stationary Engines; and the following scientific and technical works in their popular "Weale's Rudimentary Series:"—*Details of Machinery*, comprising Instructions for the Execution of Various Works in Iron, in the Fitting Shop, Foundry, and Boiler Yard, by Francis Campin, C.E. *The Metallurgy of Iron*, containing Outlines of the History of Iron Manufacture, Methods of Assay and Analyses of Iron Ores, Processes of Manufacture of Iron and Steel, &c., &c., by H. Bauerman, F.G S., fifth edition, revised and enlarged. *Navigation and Nautical Astronomy*, in Theory and Practice, by J. R. Young, new edition, including the Elements from the "Nautical Almanac" for working the problems.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed.]

LAUNCHES.—English.

Draco.—On September 26th, Earle's Shipbuilding and Engineering Company (Limited) launched from their yard at Hull, a steel steamship, built for Messrs. Thomas Wilson, Sons & Co., of Hull. As the vessel left the ways she was named by Mrs. Tarn, the *Draco.* The steamer is intended for Messrs. Wilsons' Baltic and Mediterranean service, and is built to class 20 years in the Liverpool Registry. Her dimensions are 270 ft. between perpendiculars, 34 ft. beam, and 18 ft. 3 in. depth of hold. The vessel is designed to carry a very large amount of cargo on a light draught of water, and has large hatchways, powerful steam winches, &c., also provision for water ballast in a double bottom, all fore and aft. Her gross tonnage will be about 1,800 tons, and her dead-weight carrying capacity 2,350 tons. She has a raised quarter-deck, long bridge, and topgallant forecastle, all the accommodation for officers and crew being above the tonnage deck. The engines, which also have been made by Earle's Company are 140 nominal horse-power. This steamer is precisely similar to the *Kovno* and *Grodno*, recently built at this yard for the same owners, and another sister vessel, to be named the *Cairo.* is now in course of construction.

T. S. Robson.—On September 27th, a cargo steamer of the following dimensions was launched by Messrs. Schlesinger, Davis & Co., Wallsend :—Length between perpendiculars, 248 ft.; breadth, 33 ft. 6 in.; depth of hold, 20 ft. 4½ in. The vessel has top-gallant forecastle for crew, long bridge amidships, containing cabin, pantry, storerooms, accommodation for engineers and officers, raised quarter-deck with hood aft. She has been specially designed by Messrs. Ward & Holzapfel, as an economical and large carrying cargo boat, and her deadweight capacity will be 2,251 tons on a draft of 20 ft., which is so far unsurpassed, carrying on such small dimensions, while the ship's lines and power of engines are such as to secure a very good speed. The engines will be supplied by Messrs. Thos. Clark & Co., and have cylinders of 29 by 56 ft., driven respectively with 42 in. stroke. She will receive boilers 12 ft. 3 in. diameter and 10 ft. long, with 2,700 ft. heating surface, and 90 lbs. working pressure. The vessel will also be supplied with 4 steam winches, and steam-steering gear. She has water ballast in double bottom, iron decks, and six hatches of sufficient size to enable her to carry grain in bulk according to present Board of Trade regulations, and she is intended principally for the Black Sea and American trades. As she glided into the water she was named the *T. S. Robson*, after one of the shareholders. Messrs. Schlesinger Davis & Co., have five more steamers of similar dimensions building for Messrs Ward & Holzapfel, also another vessel of larger size, so that their establishment fairly monopolized by this enterprising firm of shipowners.

Ilala.—On September 27th, the new iron ship *Ilala* was launched from the yard of the Whitehaven Shipbuilding Company. The ceremony of christening was performed by Miss Lowther, of Moresby. The measurements of the vessel are :—Length over all, 247 ft.; length between perpendiculars, 225 ft.; length at headline, 224 ft. 3 in.; extreme breadth, 37 ft. 5½ in.; breadth moulded, 37 ft. 3 in.; depth moulded, 23 ft. 4½ in.; depth of hold to floor plate, 21 ft. 8½ in. The *Ilala* is to be classed 100 A 1 at Lloyd's, and her gross tonnage is 1,330 tons. She has been built for Messrs. Lowden, Edgar & Co., Liverpool, under the superintendence of Captain Connel, of Whitehaven. The commander of the vessel will be Captain Chillo, of Liverpool. The vessel was taken into the dock, where she will be fitted with a capstan windlass, Emerson, Walker & Co's Patent, and rigged.

Malta.—On September 27th, the screw steamer *Malta*, built to the order of Mr. William D. C. Balls, Tynemouth, was launched from Messrs. John Readhead & Co.'s yard, South Shields. Her dimensions are :—Length, 259 ft.; breadth, 36 ft.; depth, 17½ ft. The steamer is built to class 100 A 1 at Lloyd's, and fitted with the latest improvements. She will be schooner-rigged, with iron lower masts, and has topgallant forecastle, half poop from bridge aft, and iron decks, and will be fitted by the builders with engines of 145-horse power nominal. This is the fifth steamer built by Messrs. John Readhead & Co. for Messrs. W. D. C. Balls and Partners. As the steamer left the ways she was christened the *Malta* by Miss Balls, daughter of Captain A. G. Balls.

Rennie.—On September 28th, there was launched from the yard of the Tyne Iron Shipbuilding Company, Willington Quay, a screw steamer built to order of J. Wait and Partners, of Newcastle and North Shields. The dimensions of the vessel are as follows: —Length, 250 ft.; breadth 34 ft.; and depth of hold from top of floors to deck, 16 ft. She is especially adapted for carrying ore, grain, and other heavy cargoes, on a light draught of water. The steamer is built on the cellular double-bottomed principle for water ballast, giving extra strength; also water ballast in the peaks fore and aft. She has a raised quarter-deck, bridge house amidships covering engine-room and stoke-hole, and topgallant forecastle. The main and quarter decks are of iron. The deck fittings consist of Harfield's patent windlass, and three steam winches. The deadweight carrying capacity of the vessel is about 1,850 tons. She is classed 100 A 1 at Lloyd's, and has been built under Lloyd's special survey, inspected by Mr. G. Boyd. The engines are of 150 horse power, and have been built by the Wallsend Slipway Company, under the inspection of Mr. Baird. The cylinders are 40 in. and 58 in., and the stroke 36 in. The boilers are of steel, with a pressure of 90 lbs. to the square in. As she left the ways she was named the *Rennie*, by Miss Williamson, daughter of Mr. G. Williamson, North Shields.

Brankelow.—On September 28th, Messrs. M. Pearse & Co. launched from their yard at Stockton an iron screw steamer of the following dimensions :—Length between perpendiculars, 300 ft.; extreme breadth, 38 ft.; depth, 25·6 feet. She is about 2,500 tons gross register, and of a deadweight carrying capacity of 3,550 tons. She has double bottom for water ballast, four steam winches, steam steering gear, &c.; is built off the three-decked rule, having two laid. She will obtain the highest class at Lloyd's under their special survey, and will be rigged as a two masted schooner, with double topsails on her foremast. Her engines are of 200 horse-power nominal, by Messrs. Blair & Co. (Limited). She will be fitted with all the most recent and improved appliances for expeditiously loading and discharging cargoes. As she left the ways she received the name of *Brankelow*, from Miss Pearse, daughter of the builder.

Louise.—On September 28th there was launched from the yard of Messrs. Raylton, Dixon & Co., Middlesbrough, a vessel built to the order of Messrs. Burdick & Cook, of London, of the following dimensions :—Length over all, 270 ft.; breadth, 35 ft.; depth of hold, 17 ft. 6 in.; and is intended to carry about 2,000 tons on a draught of 16 ft. 6 in. She is built on raised quarter-deck rule, has water ballast in both holds and in engine room, iron shifting boards, and unusually large and deep hatch coamings to fit her for the grain trade, in which she will be largely employed. She is fitted with Cochran's patent donkey boiler, exceptionally large steam winches for lifting heavy weights, and is in every way a well-fitted and arranged cargo-carrying vessel. She has cabins aft with spare berths for six pessengers, and accommodation for engineers and officers at the after end of the bridge. Her engines, which are 150 horse power, will be fitted by Messrs. Blair & Co., of Stockton. The christening ceremony was performed by Mdlle. Louise Besnard, of Paris, the name given her being *Louise.*

Thomas Allen.—Messrs. Bartram, Haswell & Co., launched from their yard, at the South Dock, Sunderland, September 29th, a large iron screw steamer, for John Allen, Esq., of London. The principal dimensions are :—Length, 258 ft.; breadth, 36 ft.; depth of hold, 18 ft. 6 in., with a carrying capacity of 2,200 tons. She has been built under special survey, for the highest class in Lloyd's Registry, and also under the superintendence of Mr. Law, on behalf of the owners. There is a poop aft, elegantly fitted up in maple and mahogany, for the accommodation of the captain and officers, a large house on deck for the engineers, and a commodious topgallant forecastle for the crew. She is fitted with a combined steam and hand steering gear by Messrs. Bow, McLachlan, & Co., Napier's patent direct acting steam windlass, Cochran's patent donkey boiler, four powerful steam winches by Clarke, Chapman, and Gurney, and trunk hatches from bridge deck to lower bunkers, to facilitate coaling. The whole of the deck arrangements are well planned, both for safe navigation and quick despatch. The engines, of 160 nominal horse power, will be supplied by Mr. John Dickinson, and are fitted with all the latest improvements in marine engineering. They have been built under the inspection of Mr. Smith, who will have charge of them when the steamer is complete. While the vessel stood on the stocks the handsome model and the fairness of the plate lines were universally admired. The launch took place at three o'clock, and as the vessel glided into the water she was gracefully christened the *Thomas Allen* by Mrs. Smith, wife of the inspecting engineer.

Ingram.—On September 29th Messrs. E. Withy & Co., launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Mr. George Steel, of West Hartlepool, for Messrs. Steel, Young & Co., of London. This vessel is No. 112 in the builder's books, and is the twentieth built by them for the same owners. Her principal dimensions are:—length, between perpendiculars, 257 ft. 6 in.; beam (extreme), 34 ft. 6 in.; depth (moulded), 20 ft. 4½ in.; and her dead-weight carrying capacity will be about 2,350 tons. She has topgallant forecastle, long bridge-house, quarter-deck, and full poop, double bottom for water ballast under both holds. The deck bulwark rails, chart-house, as also the skylights and companions, are of iron. She will be fitted with four steam winches, donkey boiler, patent windlass, and will be rigged as a double topsail schooner. She has been built under Lloyd's special survey for the 100 A 1 class, and under the personal superintendence of Mr. Steel, and will be commanded by Captain Leisk. Engines of 150 nominal horse power, will be fitted by Messrs. J. Richardson & Sons, of Hartlepool. On leaving the ways the vessel was christened *Ingram* by Miss Charlotte Young, of London.

Woodside.—On September 13th the screw steamer *Woodside*, the second vessel constructed by the North of England Shipbuilding Company, was launched from the company's yard at Pallion, Sunderland. The vessel has been built to the order of Mr. T. G. Greenwell, of Sunderland, under the superintendence of Mr. Glover, and will be classed in Lloyd's highest list, 100 A 1. Her dimensions, are as follows:—Length, between perpendiculars, 258 ft., over all, 270 ft.; breadth, 36 ft.; depth, 18 ft. 6 in.; and will carry a cargo 2,300 tons deadweight. Her decks are all of iron, including a raised quarter-deck, topgallant forecastle, with a full poop aft for cabin, and she is strongly built throughout, having six water-tight bulkheads, and four large hatches conveniently placed for the loading or discharging of cargo, for each of which one of Messrs. Clarke, Chapman & Gurney's steam winches will be supplied. The steamer will also be fitted with an improved quarter-master steam steering gear, for which Messrs. Dixon & Wilson, of Sunderland, are the agents, Harfield's patent windlass, and other modern appliances. The engines, of 160-horse power, have been constructed by the North-Eastern Marine Engineering Company, also under the superintendence of Mr. Glover, and will embrace all the latest improvements. The ceremony of christening the steamer was performed by Mrs. Greenwell, wife of the managing owner.

Leicester Castle.—On September 30th there was launched from the Shipbuilding and Engineering Works of Messrs. Oswald, Mordaunt & Co., Southampton, a sailing ship of 2,050 tons register, named the *Leicester Castle*, built to the order of John Coupland, Esq., Goscate-hall, Leicester, of the following dimensions:—Length, 274 ft.; breadth, 46 ft.; depth of hold, 24 ft. The ship is built with full poop, monkey forecastle, and large midship house for crew. She is fitted with Harfield's patent windlass for lifting anchors, and all the latest improvements. This is the third ship built for the same owner, and is intended to take the highest class both at Lloyd's and the Liverpool Underwriters' Registry. The ceremony of naming the vessel was performed by Mrs. Henniker. During the course of construction the vessel has been inspected by Mr. Malcolm and Captain Boag.

Lansdowne Tower.—On September 30th, this iron screw steamer, built for Messrs. Stumore, Weston & Co., of London, was launched from Messrs. Wigham Richardson & Co.'s yard on the Tyne. The extreme dimensions are:—Length, 335 ft.; breadth, 38 ft. 3 in.; depth, 28 ft. She is classed 100 A 1 under Lloyd's special survey of hull and engines, and has their machinery certificate. She will carry a passenger certificate, her hull, engines and boilers, and outfit being under Board of Trade survey, and to the requirements for passenger steamers. The cargo holds are of a cubic measurement capacity of 5,000 tons. The total dead weight carrying capacity is 4,000 tons. The frames are carried up, plated over, and decked in for a length of 80 ft. amidships, forming a protection to the engine-room and stokehole casings, officers' rooms, &c., in heavy weather. Steam steering gear is fitted in the bridge wheelhouse, and powerful screw gear in the after wheelhouse, Chadbourn's reply telegraph being fitted from the bridge to both after wheelhouse and engine-room. The cargo hatches are worked by four large horizontal steam winches, and both anchors by a powerful crane, and Emerson & Walker's patent steam windlass. A saloon, with accommodation for 15 first-class passengers, is fitted up in an iron deck-house aft, and communication with the 'tween decks arranged. The engines are compound, of 350-horse power nominal, and are also by Messrs. Wigham Richardson & Co. Diameter of cylinders, 40 and 74 in.; stroke of piston 48 in., supplied by steam at 80 lbs. pressure from two large double-ended steel boilers. The indicated horse-power will be 1,750, and the ship is expected to attain a speed of 13 knots on trial.

Angers.—On October 3rd., Mr. D. P. Garbutt, launched at Hull, a steamer named the *Angers*, and built for Messrs. Angiers Brothers, of London. The *Angers*, which is intended for the Australian and San Francisco trade, is a vessel 330 ft. over all, 40 ft. beam, and 28 ft. 3 in. deep. She has a deadweight capacity of 4,400 tons, or about 5,000 tons displacement. She has been built of extra strength, and according to the Admiralty requirements for the conveyance of horses and troops. She will be schooner-rigged, with double topsailyards. Her water ballast capacity will be 500 tons. Her engines, which have been built by Messrs. C. D. Holmes & Co., of Hull, will have an indicated power of 1,450-horse or 300-horse power nominal. The boilers are of Siemen's steel, and the engines are of the compound surface-condensing style, having a diameter of cylinder of 40 in. and 72 in., with a 48 in. stroke.

Empress.—On October 10th, a steam yacht, named the *Empress*, building for Sir Andrew Barclay Walker, was launched from the yard of Earle's Shipbuilding and Engineering Company, Hull. This yacht has been constructed to the designs and under the superintendence of Mr. St. Clare Byrne, naval architect, of Liverpool, and is a similar type of vessel to the well-known yacht *Sunbeam*, belonging to Sir Thomas Brassey, M.P., which was also designed by Mr. Byrne. Her dimensions are 150 ft. between perpendiculars, 26 ft. beam, and 14 ft. 6 in. depth of hold; and her tonnage is about 490 tons Y.R.A. rule. She has been built of iron under Lloyd's special survey for the 100 A class, yacht rules. Her engines, which have also been made by Earle's Co., are of the compound surface condensing type, and of 400 indicated horse-power. After the launch the vessel was towed into one of the company's tidal docks for completion, where she will receive her masts, machinery, and cabins.

Romanby.—On October 12th, an iron screw steamer was launched from the building-yard of Messrs. W. Gray & Co., West Hartlepool, built to the order of Messrs. Middleton & Co., of West Hartlepool, under the survey of Captain Dew. Her dimensions are as follows:—Length between perpendiculars 256.6; breadth, 34.6; depth of hold, 19.8. She is classed 100 A 1 (the highest class) at Lloyd's, and is intended for the Indian and general trade, to carry 2,350 tons dead weight. She has a poop aft fitted up for the accommodation of captain and officers, raised quarter deck, bridge, and topgallant forecastle for crew. She will be rigged as a double topsail schooner, and has a double bottom in each hold for water ballast. She is fitted with all the recent improvements, including four steam winches, and Emerson & Walker's windlass. Her engines are built by Black, Hawthorn & Co., Gateshead-on-Tyne. On leaving the ways, the christening ceremony was performed by Miss Helen M. Middleton, of Seaton Carew, the vessel being named *Romanby*.

Genista.—On October 12th, an iron sailing ship of the following dimensions was launched from the shipbuilding and engineering works of Messrs. W. H. Potter & Son, Queen's Dock, Liverpool, viz.:—Length, 270 ft.; breadth, 39 ft.; depth, 24 ft.; tonnage, B.M., 1,995 tons; tonnage nett register, 1,800 tons; and deadweight capacity, 3,000 tons. The vessel was named the *Genista* by Miss M. Sandbach, of Hagoduras, Denbighshire. The *Genista* has been built to the order of Messrs. Sandbach, Tinne & Co., of Liverpool, and is the third ship built for them by Messrs. Potter. She is fitted with an iron poop, iron deckhouses, together with the most recent improvements, and takes the highest class in Lloyd's and the Liverpool underwriters' books, her scantlings being in excess of the requirements of both books. The *Genista* was built under the superintendence of Captain Westlake, and will be commanded by Captain Cook, late of the *Romsdal*.

On October 14th Messrs. Robert Thompson & Sons, of Southwick, Sunderland, launched from their shipbuilding yard an iron screw steamer, which has been built under Lloyd's special survey to class 100 A 1, and Board of Trade for the spar deck rule. The dimensions are:—Length over all, 345 ft.; breadth. 40 ft.; and depth, 29 ft. 7 in. The vessel has a large deckhouse aft, fitted up for captain and passengers, cape over stern to protect houses, a long bridge amidships with accommodation for officers and engineers, and accommodation for crew and firemen in forecastle. She has cutwater stem, iron chart and wheelhouse, six bulkheads, water ballast aft divided into two compartments, and in mainhold and forepeak, three-masted schooner rig, four large hatches, five boats, four steam winches, and horizontal donkey boiler by Messrs. R.

Roger & Co., and has patent steam-steering gear amidships, screw gear aft, Harfield's patent windlass, and all the latest improvements. She will be fitted with engines of 1,600 indicated horse power, with two large double-ended boilers by Mr. J. Dickinson, Palmer's Hill Engine Works.

Clyde.—On October 14th, an iron paddle steamer, named the *Clyde* was launched from the yard of Messrs. T. & W. Toward, St. Lawrence, Newcastle. The dimensions are:—Length, 120 ft.; beam, 20 ft.; hold, 10 ft. 6 in. She will be classed 90 A at Lloyd's, with Board of Trade passenger certificate. Her engine is side-lever surface-condensing, with 38-in. cylinder, and 58in. stroke, to be supplied by Messrs. G. P. Hepple & Co., North Shields (successors to the late Mr. Thomas Hepple). The steamer is built for the Britannia Steam Shipping Company, Scarborough, and this boat is the pioneer of an intended fleet of surface-condensing engined boats to be employed in the Doggerbank fishery, and during the summer season will be equipped and utilized for excursion service.

Dauntless.—On October 14th there was launched from the building-yard of Messrs. T. & W. Smith, North Shields, a screw-steamer, named the *Dauntless*, of the following dimensions:—Length, 268 ft.; breadth, 36 ft. 6 in.; depth, 18 ft. 7 in ; gross tonnage, 1,630. The engine, of 200-horse power, will be fitted by Messrs. Hawks, Crawshay & Sons, Gateshead, and patent direct steam windlass by Messrs. Emerson, Walker & Co., London. She is classed 100 A 1 at Lloyd's, and has been built to the order of Messrs. Hall Brothers, Newcastle. The vessel has been well fitted with all the latest improvements, and will be employed in the general trade. She was named by Miss Annie Cooke, of Hexham.

Wordsworth.—On October 14th, Messrs. W. Gray & Co., launched from their yard at West Hartlepool an iron steamer of the following dimensions:—Length, 285 ft.; breadth, 36 ft.; depth, 24 ft. 3½ in.; class 100 A1 at Lloyd's. The vessel is built on the three-deck principle, to the order of Messrs. Glover Bros., London, and is intended for the Indian trade, to carry 3 000 tons. She is fitted with all recent improvements, including steam-steer-gear, steam windlass by Emerson, Walker & Co., London, and four steam winches. She has a double bottom in each hold for water ballast. The engines are to be fitted by Messrs. T. Richardson & Sons, of Hartlepool. On leaving the ways the christening ceremony was performed by Mrs. J. Buchanan, of Liverpool, the vessel being named the *Wordsworth*.

Owain Tudur.—Messrs. Samuel Brothers, of Llanelly, launched the other day a steamer named the *Owain Tudur*, constructed for Messrs. Parry, Jones & Co., of Liverpool. Her length is 129½ ft.; breadth, 20 ft.; depth of hold, 10 ft. 3 in.; gross tonnage about 230 tons; built under special survey, and classed 100 A 1 at Lloyd's. She has water ballast, and is fitted with all the newest appliances for speedy loading and unloading, and Messrs. Emerson & Walker's patent windlass. She will be fitted by Messrs. Nevils, of Llanelly Ironworks, with compound surface condensing engines of 55 horse-power nominal, and will have cylinders of 16 in. and 32 in. respectively in diameter, the piston stroke being 22 in. The steamer will be employed in the coasting trade. The ceremony of naming her the *Owain Tudur* was performed by Mrs. Samuel, of Carmarthen.

Britannia.—On October 16th, Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw-steamer, built to the order of the Sunderland Steam Shipping Company, of which Messrs. Pecket & Thompson are the managers. Her principal dimensions are:—Length, per register, 277 ft.; breadth, 36 ft.; and depth of hold, 18 ft. 6 in.; and is built to the highest class in Lloyd's registry. Constructed with short full poop, long raised quarter-deck, long bridge-house, and topgallant forecastle, with water ballast in fore and aft holds, and is to be fitted with engines and boilers by by Mr. John Dickinson, of Palmer's-hill Engine Works. On leaving the ways she was named the *Britannia*.

Umberto Arbib.—On October 18th, there was launched from the shipbuilding and engineering establishment of Messrs. Oswald, Mordaunt & Co., at Southampton, a screw-steamer built to the order of Messrs. E. & E. Arbib, London, of the following dimensions:—Length, between perpendiculars, 260 ft.; breadth, 36 ft.; depth of hold to floors, 18 ft.; gross tonnage, 1,700 tons. The ship and engines are built under special survey, and are to class 100 A1 at Lloyd's. The engines by the same firm are on the compound principle, having cylinders 30 in. and 60 in. and a stroke of 42 in. Steam being supplied by two boilers 13 ft. diameter, with a working pressure of 90 lbs. She is fitted up with all the latest improvements, having steam steering gear by Messrs. Bow, M'Lachlan & Morrison, and Emerson and Walker's patent windlass for lifting anchors. The vessel has been built under the inspection of Mr. Casey, of London. The ceremony of naming the vessel the *Umberto Arbib* was performed by Miss Mordaunt.

LAUNCHES.—SCOTCH.

Aston Hall.—On September 13th, there was launched from the shipbuilding yard of Messrs. Gourlay Brothers & Co., a fine iron screw steamer of 3,700 tons gross register. She has been built to the order of the Hall Line, Liverpool, and as she left the ways she was gracefully christened the *Aston Hall*, by Miss Gourlay, daughter of Mr. Gershom Gourlay. There was a large crowd of spectators to witness the launch, which passed off most successfully. The *Aston Hall* measures 360 ft. in length, 42 ft. 6 in. in breadth, and 27 ft. 7½ in. depth in hold. Her nominal horse power is 350, with cylinders of 40 and 76 in. diameter. She is classed 100 A at Lloyd's; but she is much stronger than was necessary to secure her being so classed, The *Aston Hall* is constructed to carry a large deadweight cargo, and every facility has been introduced that the loading and discharging may be effected with great rapidity. She is schooner-rigged, and under her topgallant forecastle accommodation is provided for the crew. The officers' quarters are under her long bridge deck amidships. She has a poop in which cargo may be carried. The *Aston Hall*, which is a fine looking vessel, will be engaged in the East Indian trade. After the launch a number of gentlemen were entertained to cake and champagne in offices, and success to the good ship *Aston Hall* was, on the call of Colonel Williamson, of Lawers, heartily pledged.

Loire Inferieure.—On September 27th, there was launched from the Craigie Shipbuilding Yard (Messrs. Pearce Brothers) a fine iron screw steamer capable of carrying 1,100 tons. The vessel, which is a smart-looking craft, is schooner-rigged, and will be fitted with engines of 90 horse-power nominal. She is built to the order of the Compagnie Nantaise, and will be engaged in the Mediterranean trade, hailing from Nantes, France. Her dimensions are—Length, 200 ft.: breadth, 29 ft.; depth in hold, 13 ft. 9 in. She is built to class 100 A1 at Lloyd's, but she is much stronger than the requirements of her class. As she left the ways she was gracefully christened the *Loire Inferieure* by Mrs. Samuel Boase, Newport. The vessel will be commanded by Captain Cloître, and it is expected will be ready to proceed to sea in about three weeks. After the launch a number of ladies and gentlemen were entertained to cake and champagne in the drawing-office. Mr. Alfred W. Pearce, presided, and among those present there were Mrs. Samuel Boase: Miss Hannen; Mr. Henry Boase; Mr. Samuel Low, Monifieth; Mr. Cooper, Lloyd's Surveyor; Mr. T. Armitt; Mr. J. Ross, London; Mr. Richard A. Pearce; Mr. Welch, Edinburgh, &c. "Success to the good ship *Loire Inferieure*" was proposed by the Chairman, and, in the absence of Mons. Bonnefoy, Captain Cloître replied in French, remarking that he had no doubt the vessel would be a credit to her builders and prove a profitable undertaking to her owners.

Shap Fell.—On September 27th the Campbeltown Shipbuilding Company launched from their yard at Trench Point a steamer of about 500 tons burthen, her dimensions being 155 by 24 by 11. This vessel is built to the order of Messrs. Hume, Smith & Company, of Liverpool, and is the sixth steamer of their "Fell Line." She is built to the highest class of Lloyd's under special survey, has every facility for speedy loading and discharging of cargo, and is to be fitted with a pair of compound surface condensing engines of 70 horse-power by Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow. The vessel was named the *Shap Fell* by Miss Greenlees, of Hazelbank, Campbeltown. The hull and machinery have been constructed under the superintendence of Messrs. W. R. M'Kaig & J. Carlton Stitt, of Liverpool, consulting engineers to the owners.

Kiang-Yu.—On September 28th there was launched from Pointhouse Shipyard, Partick, by Messrs. A. & J. Inglis, a paddle steamer for the China river trade. On leaving the ways the vessel was named *Kiang-Yu*, by Mrs. Knights, wife of Captain Knights, who has come home to take command.

Hye Leong.—On September 29th the *Hye Leong*, an iron screw steamer of about 550 tons, was launched by Messrs. Blackwood & Gordon, Port Glasgow. She has been built to the highest class at Lloyd's, and under the superintendence of Messrs. MacNicoll & Smith, Glasgow, for trading in the East. Her builders will fit her with compound surface condensing engines of 110 horse-power nominal.

Craigton.—On September 29th Messrs. Ramage & Ferguson launched, from their shipbuilding yard at Leith, an iron screw steamer for the Glasgow Steamship Company (Limited), of which Messrs. Walker, Donald & Co. are the managers. Her principal dimensions are:—Length, keel and fore rake, 275 ft.; breadth, moulded, 37 ft.; and depth, moulded, 23 ft. 6 in.; gross tonnage, about 2,100 tons; deadweight capacity, 2,800 tons. The machinery, of 200 horse-power nominal, which will be supplied by Messrs. Blaikie Brothers, Aberdeen, will have cylinders 32 in. and 64 in. by 42 in. stroke, and steam will be supplied by two large boilers and all modern improvements, including steam steering gear, Emerson, Walker & Co.'s Patent, steam windlass, &c. The steamer on leaving the ways was named the *Craigton* by Mrs. M'Ilwraith, of Twinberry, and was then towed round to the berth alongside the yard to be fitted out.

An Ding.—On September 29th a new twin-screw patent hopper dredger, built and engined by Messrs. W. Simons & Co., was launched complete from their works at Renfrew. It is named *An Ding*, and is the property of the Chinese Government. It has been built under the inspection of Mr. Weir and Captain Stobo. This vessel will dredge from 2 to 30 ft. depth of water, and also carry 600 tons of its own spoil at a speed of seven miles an hour.

Tarawera.—On September 30th Messrs. Denny & Bros. launched from Leven Shipyard, Dumbarton, a steel screw-steamer of 1,950 tons gross measurement, for the Union Steamship Co. of New Zealand (Limited). On leaving the ways she was named the *Tarawera*, by Mrs. M'Crae, of Glasgow. The dimensions of the *Tarawera* are:—Length between perpendiculars, 285 ft.; breadth, moulded, 36 ft.; depth, moulded, 25 ft. She has been constructed of Siemens-Martin steel, under special survey of Lloyd's, and classed in their register 100 A 1, three-decked. She is built on the continuous cellular bottom principle, with solid floors, and adapted for water ballast. Throughout the machinery space the structural system of deep plate frames and hold-side stringers has been adopted. She will have accommodation for 124 first-class passengers on main and upper decks, and 80 second-class passengers on main deck. The officers and engineers will be accommodated in the midship side-houses under bridge-deck, and the firemen and crew will occupy the forecastle. The vessel will be fitted by Messrs. Denny & Co. with compound surface condensing engines, having cylinders 38 in. and 68 in. diameter, and the stroke of piston 45 in. While being constructed the *Tarawera* has been under the inspection of Mr. John Darling, superintending engineer of the company.

Dilsberg.—On September 30th Messrs. Murdoch & Murray launched from their yard at Port Glaagow a screw steamer of about 1,560 tons, which, on leaving the ways, was named *Dilsberg*, by Miss Annie Manifold, Partick. She has been built of the Steel Company of Scotland's steel, for Messrs. Raeburn & Verel, Glasgow, for the Eastern Trade, and is classed 100 A 1 at Lloyd's; has steam windlass, steam stearing gear, lighthouses, &c., and is built on the three-deck rule, with water ballast in both holds. Her construction has been superintended by Messrs. M'Nicoll & Smith, Glasgow, and she will be fitted with compound engines of about 170 horse power nominal by Messrs. Kincaid, Donald & Co., Greenock. She proceeds after completion to the Cape, under charter to Messrs Donald Currie and Co.

Taurus.—On October 4th, Messrs. A. M'Millan & Son, Dumbarton, launched from their dockyard at Dumbarton, the French steamship *Taurus*, 1,800 tons and 1,500-horse power for the fleet of MM. Fraissinet & Co., of Marseilles. This vessel, which received her name from Mrs. M'Millan, of College-park, is to be engaged in the Mediterranean and Black Sea Trades of the Company, carrying a considerable number of first and second class passengers, the French Mails, and cargo. The *Taurus* is the sixth steamer and fourth similar vessel built by Messrs. M'Millan for MM. Fraissinet & Co., and they have still two duplicates of the *Taurus* to launch. During the last three years this company have had built in this country 16,000 tons of steam shipping. She has an Emerson & Walker's patent direct steam windlass with warping capstan attached. The *Taurus*, which is being supplied with machinery by Messrs. Denny & Co., and was launched ready to receive it on board, has been built, so far, in the unusually short period of sixty-six working days since the first frame was bent.

Kelvinside.—On October 11th, Messrs. Barclay, Curle & Co. launched from their shipbuilding-yard, Whiteinch, Glasgow, an iron sailing ship for Messrs. Walter Duncan & Co., East India merchants, Glasgow. The vessel's dimensions are 252 ft. by 38 ft. 4 in. by 23 ft., and her tonnage 1,550 gross. On leaving the ways she was named the *Kelvinside* by Miss Duncan, of Kelvinside.

Manuel L. Villaverde.—On October 12th, there was launched from the shipbuilding-yard of Messrs. Lobnitz & Co., Renfrew, an iron screw steamer, built to the order of Compania Transatlantica of Barcelona. The vessel is of the following principal dimensions, viz.:—Length, 260 ft. by 31 ft. beam by 24 ft. depth, and will be fitted with powerful compound engines constructed by the same builders. There will be fitted throughout the vessel first, second, and third class accommodation for passengers, and as the steamer is intended for the Spanish mail and passenger service on the coast of Cuba, in connection with the home service steamers, every attention will be paid in the completion of the vessel as regards ventilation, comfort, and general utility. The ceremony of naming the vessel *Manuel L. Villaverde* was performed by Miss Lobnitz.

Dundee.—On October 14th, there was launched from the shipbuilding-yard of Mr. W. B. Thompson, Dundee, the largest iron sailing vessel yet built in Dundee. She is of 2,100 ton gross. Her dimensions are.—Length 310 ft.; breadth, 43 ft.; and depth of hold 23 ft. As she left the ways she was gracefully christened the *Dundee* by Miss Nicoll of Riverleigh. In nautical parlance the vessel may be described as "a poor man's ship," which, being interpreted, means that she will not only take a large cargo, but also sail well. It is expected that she will carry 3,000 tons deadweight, and bring 15,000 bales of jute from Calcutta or Chittagong to Dundee. Her great breadth will enable her to come into the harbour when fully laden, and without having to lighten in the river. She may also be moved in dock without any ballast. There are four hatches, and to secure rapidity in loading and discharging, and also to lighten the labour of the crew in working the vessel, steam winches, Emerson, Walker & Co.'s powerful direct-acting steam windlass, and capstan will be fitted up. Special attention has alss been paid to ventilation, so that the cargo may arrive in good condition. The *Dundee* will have four masts, and be square-rigged on three masts and barque-rigged on the jigger-mast. She has been built to the order of Captain Charles Barrie, the managing owner, and under his special supervision. She will be engaged in the Indian and San Franciscan trade, and will be commanded by Captain Naughten, who has had large experience in the Indian trade, and who formerly commanded Captain Barrie's ship *Calcutta*. From the spacious 'tween decks of the *Dundee* she would make a very fine emigrant or troopship.

Glenmore.—On October 14th, a large screw steamer was launched from Kinghorn shipbuilding yard (Messrs. Key & Sons). The dimensions of the vessel, which has been specially built for the Danube and Black Sea grain trade, are as follows:—Length between perpendiculars 265 ft.; breadth of beam 37 ft.; depth of hold 18 ft. 11 in.; gross tonnage 1,820. She is built with full forecastle, large enclosed bridge, and a quarter deck; and will carry 2,500 tons dead-weight cargo on a mean draught of 17 ft 3 in. On leaving the ways the vessel, which is built for the same owners as the s. s. *Mentmore* (which was launched from the yard in February last), was christened the *Glenmore*, the ceremony being performed by Miss Key. The engines, which will be supplied by the builders from their works at Kirkcaldy, are of 160-horse-power nominal, indicating about 1,000-horse-power. The cylinders are 30 and 60 in. in diameter respectively, with a stroke of 3 ft. 3 in. This vessel, as well as a sister ship, the *Heathmore*, which will be launched from the yard in about two months hence, has been constructed under the superintendence of Captain J. Johnston, the shipwright superintendent for the owners (Messrs. Wm. Johnston & Co., Liverpool); while the engines and boilers have been built under the supervision of Mr. E. Esplen, the superintending engineer. Immediately after the launch, which, notwithstanding rough weather, passed off successfully, an adjournment was made to the drawing office, when "Success to the *Glenmore*." "The Owners," "The Builders," and a few other toasts were given. The vessel was towed round to Kirkcaldy, where she will be fitted out for sea.

Celtic.—On October 16th, Messrs. John Fullerton & Co. launched from Merksworth building yard, Paisley, an iron screw steamer of the following dimensions:—120 ft. by 20 ft. by 9 ft. 6 in. hold; and 230 tons B.M. The vessel will be fitted with a pair of compound engines by Messrs. William King & Co., Dock engine and boiler works, Glasgow, of 40-horse-power nominal, cylinders 17 in. and 30 in. by 22 in. stroke, and has been built to the order of Messrs. J. & J. Macfarlane, Glasgow. On leaving the ways she was named the *Celtic* by Miss Fullerton, Paisley.

Taiwan.—On October 17th, Messrs. Scott & Co, Cartsdyke, Greenock, launched from their yard a screw steamer of 1,800 tons, built to the order of Messrs. Swire & Sons, of London, for the China trade. The new steamer is 272 ft. long; 35 ft. broad; and 23 ft. 6 in. deep. She is similar to the *Whampoa* and *Woosung*, recently launched by the same firm, and as she left the ways she was named the *Taiwan*. After the launch the new vessel was towed to the Victoria Harbour, where she will have her machinery put on board.

Nigel.—On October 20th, there was launched from the shipbuilding yard of Messrs. Robert Steele & Co., Greenock, a screw steamer of about 1,700 tons, built to the order of Messrs. George Hood & Co., Glasgow, for the Mediterranean trade. This steamer has been built to the highest class at Lloyd's, and possesses all the latest improvements in hull and machinery. On leaving the ways the vessel was named the *Nigel*, the ceremony being performed by Mrs. Robertson, of Glasgow. The vessel was afterwards taken in tow to the East India Harbour, Greenock, where she will receive her boilers and machinery, to be supplied by the builders.

LAUNCH.—IRISH.

Skerryvore.—On October 12th an iron screw steamer was launched by Messrs. Workman, Clark, & Co., at their shipyard, Belfast. The vessel is built to the order of the Clyde Shipping Company, and is intended for their Belfast and London trade, via Southampton. Her dimensions are:—Length of keel and forerake, 225 ft.; breadth, 30 ft. 10 in.; depth of hold, 15 ft. 6 in.; with a double bottom fore and aft on the bracket system, and will be classed 100 A 1 at Lloyd's, under special survey. The vessel is to be rigged as a two-masted schooner, with a foresail and foretopsail. She has a poop-deck 130 ft. long, and accommodation for 48 first-class passengers and 50 steerage passengers. She is fitted up with three steam cranes on deck for discharging cargo, and has two steam winches, all of the most approved and newest style, and made by Messrs. Muir & Caldwell, of Glasgow. The engines, which are of the direct-acting compound surface condensing type, cylinders 27 in., and 58 in. diameter, with a stroke of 28 in., are being constructed by Messrs. John Rowan & Sons, Belfast. The vessel was christened *Skerryvore* by Miss Pinkerton, daughter of the agent for the Clyde Shipping Company. This is the second steamer built for this company by Messrs. Workman, Clark, & Co., and will be ready for sea in about three weeks. She will be entirely fitted out at Belfast.

LAUNCH.—GERMAN.

H. A. Hartmann (s.s).—On October 7th there was launched from the yard of the Flensburg Shipbuilding Company, a new steamer, built to the order of Mr. H. C. Clausen, at Christianssund. She is well decked, and of following dimensions:—Length, 168 ft.; breadth, 24 ft. 8 in.; depth of hold. 14 ft. Her engines are 80 nominal horse power. As she left the ways she was gracefully christened *H. A. Hartmann*, by Mrs. E. Bredsdorff.

LAUNCH.—FINLAND.

Spasatel.—On September 13th, Messrs. Wm. Crichton & Co. launched from their shipbuilding yard at Abo, an iron screw steamer, of the following dimensions:—Length 156 ft.; breadth 28 ft.; depth of hold 12 ft.; draught 9 ft. She is built to the order of a Company at Astrachan for the transport of Naphtha on the Caspian Sea, and her holds are subdivided into cisterns for carrying the Naphtha in bulk, of which she will carry about 500 tons. She is being fitted with compound surface condensing engines of 400 indicated horse-power, and will be ready for delivery in St. Petersburg in about fourteen days.

LAUNCH.—HOLLAND.

Monica.—During the week ending September 23rd the shipbuilding and engineering works Company, "de Maas," Limited, launched from their yard at Delfshaven (Holland) a screw steamer, named *Monica*, built to the order of the Crofton Shipping Company, Limited, Hull. The vessel, to be engaged in the Baltic and Black Sea trade, has the following dimensions:—Length, between perpendiculars, 212 ft.; beam 30 ft.; depth of hold 14 ft.; displacement 1720 tons; carrying capacity 1100 tons, on a mean draught of 13 ft. 3 in.; gross tonnage 923 net; tonnage 546; four waterballast tanks, 210 tons; three hatchways aft 29 ft. 4 in. by 16 ft.; middle 25 ft. 8 in. by 16 ft.; fore 16 ft. 6 in. by 16 ft.; Schooner rigged, top-gallant forecastle, long bridge amidships, raised quarterdeck and halfpoops for captain's cabin, fitted with three steam winches and Hatfield's patent windlass. The engines, supplied by the builders of the vessel, consist of two cylinders, 27 in. and 50 in. diameter with 33 in. stroke, with surface condenser, air and circulating pumps, feed and bilge pumps of the ordinary design. In event of heavy leakages there are not less than nine steam pumps which can be used. The boiler, 16 ft. 3 in. diameter, supplies steam to a working pressure of 85lbs. The vessel has been built according to Lloyd's rules for the 100 A 1 class, and has been surveyed during her construction by Captain J. C. Thompson, who will command her. This is the first steamer, we believe, that has been built and engined in Holland to the order of an English firm.

LAUNCH.—SWEDISH.

Ceres.—On September 30, this vessel, built by Kockums Mekaniska Werkstads Aktie Bolag Malmo for the Sydsvenska Angfartygs Aktie Bolaget, also of Malmo, was launched. She is 230 ft. long, 30 ft. beam, depth of hold to main deck, 14 ft. 9 in. The vessel is awning decked, built with double bottom all fore and aft, also large main tank to lower deck, in addition to tanks in the fore and aft peak. She is to be fitted for carrying about 500 head of cattle and 250 emigrants. Cargo deadweight 950 tons. Class 100 A 1 in London Lloyd's.

TRIAL TRIPS.

The Isla de Luzon.—The trial trip of the *Isla de Luzon* took place on September 16th. She is a screw steamer built by Messrs. Oswald, Mordaunt & Co., of Southampton, for the Compania General de Tabacos de Filipina's of Barcelona. Her dimensions are:—Length, 392 ft.; breadth, 44 ft. 3 in.; depth, 34 ft.; gross tonnage, 4,252; nett tonnage, 2,773; with engines of 800-horse power nominal; diameter of high-pressure cylinder, 52 in.; diameter of low-pressure cylinder, 94 in.; length of stroke, 60 in.; the boilers have a working pressure of 90 lbs. to the square inch. A speed of over 15 knots was attained over the measured mile, and the engines worked smoothly and well during her trial trip of eight hours.

Waterloo (s).—On September 26th the *Waterloo* (s), built by Messrs. John Readhead & Co. to the order of Mr. W. D. C. Balls, Tynemouth, took her trial trip. She is classed 100 A 1 at Lloyd's, and fitted with the latest improvements, suitable for the grain trade. Dimensions:—Length, 255 ft.; breadth, 36 ft.; depth, 19½ ft.; engines, 140-horse power nominal, fitted by the above firm, with 80 lbs. pressure and 75 revolutions per minute. She attained a speed of 10 knots an hour. After her trial trip the vessel proceeded to Tyne Dock to load a cargo of coals for Cette, and will be commanded by Captain Debnam.

Benwell Tower.—On September 26th the new screw steamer *Benwell Tower*, built by Messrs. Stumore, Weston & Co., of Liverpool and London, by Messrs. J. Wigham Richardson & Co., Neptune Shipyard, Low Walker, had a satisfactory trial trip at sea. The vessel is 310 ft. long, 37 ft. broad, and 28 ft. deep, and she is propelled by a pair of engines, also built by Messrs. Richardson & Co., of 300-horse power nominal, and 1,400-horse-power indicated. She is supplied with Emerson, Walker & Co.'s patent steam windlass. During the trial the engines worked without the slightest hitch, and a speed of 11¾ knots per hour was attained.

Werra.—On September 28th the trial trip of this steamer, built by Messrs. John Elder & Co. for service between Bremen and New York, took place and passed off successfully. The *Werra* is 5,109 tons gross, 450 ft. long over all, 46 ft. broad, and 36 ft. 6 in. deep, with accommodation for 170 first, 90 second, and 1,100 third-class passengers. The engines are constructed on the same model as those of the Orient Liner *Austral*. The contract horse-power development was 5,600, but when running the measured mile it reached as high as 6,700. The contract stipulated for a speed of 16 knots, on a consumption of coal not exceeding 1,936 lbs. per indicated horse power per hour. On the first up run she did the mile in 3m. 32s., and the second run down in 3m. 26s.—the mean of the two runs being 3m. 29s., or equal to a speed of 17·225 knots per hour. On the previous day, on a trial extending over six hours, the result obtained was 16·7 knots per hour, and the consumption of coal at the rate of 1,225 lbs. per indicated horse-power, with 66 revolutions per minute.

The Polyphemus, torpedo ram, Commander May, arrived at Spithead on September 29th from Sheerness, and afterwards steamed into harbour. She came under easy steam all the way, five of her boilers only being used. Though intended for 120 lb. pressure, they were arranged to blow off at 70 lb., while the air pressure in the stokehole was equal to 1 in., instead of 3 in., which is intended to be the normal draught. The engines worked very well and very little heating was observed in the boilers. *The Polyphemus* is an entirely exceptional and experimental ship, and has been fitted with experimental locomotive boilers and experimental torpedo gear. In these circumstances, it is not surprising that she should exhibit various defects. During her passage from Sheerness she is reported to have rolled like a gunboat, notwithstanding her displacement of 2,600 tons. It is intended to replace her present boilers by cylindrical boilers of the ordinary return-tube pattern, working up to 120 lbs., and, in consequence of the peculiar construction of the ship, it is thought that the easiest method of relieving her of her present set will be to cut holes in her bottom and drop them through. While the set of new boilers are being constructed by the contractors she will be put through a series of trials by the officers of the *Vernon*, with the object of getting over the difficulties which at present prevent either her broadside or direct ahead torpedoes being used with effect. She will also be fitted at Portsmouth with electrical firing and signalling gear.

Govino.—On September 30th the *Govino* (s), which was recently launched from the Deptford Yard, Sunderland, had a successful trial trip along the coast. Her dimensions are as follows:—Length over all, about 300 ft.; breadth, 37 ft. 4 in.; depth of hold from spar deck, 27 ft. 3 in.; and her deadweight capacity is about 3,100 tons. She is of the highest class at Lloyd's, and is fitted with water ballast; Emerson, Walker & Co.'s patent direct-acting steam Windlass, Higginson's steam quartermaster, steel hawsers, and other late improvements. The *Govino* has special facilities for discharging quickly, having four large steam winches and donkey boiler, and is particularly adapted for conveyance of troops and emigrants, having side-lights placed all round her 'tween decks. The engines, by Mr. George Clark, are 200-horse power, with cylinders 33 in. and 62 in., by 42 in. stroke, and are fitted with steam starting and reversing gear, Smith & Pinkney's patent atmospheric governor, &c. The vessel steamed out in the morning, and a splendid run was made southward as far as Huntcliffe foot, on the Yorkshire coast. The engines worked very smoothly, and a speed of 10½ knots was easily obtained. The *Govino* arrived at West Hartlepool in the evening to load a part cargo, and then proceed to London to complete under charter with the International Line from London to the Cape of Good Hope.

Holderness.—On September 30th the new steamship *Holderness*, built at Hull by Earle's Shipbuilding and Engineering Company (Limited), went out for her trial trip. The principal dimensions of the vessel are:—Length between perpendiculars, 255 ft.; breadth, 34 ft. 6 in.; depth of hold, 17 ft. 6 in. She has a bridge amidships, a raised quarter-deck, and a topgallant forecastle, also has provision for water-ballast in the after-hold and fore-peak, and is constructed to carry a large quantity of cargo on a light draught of water. The has been built under Lloyd's special survey to class 100 A 1, and is intended for the Baltic and Mediterranean trade. The engines, which also have been made by Earle's Company, are of the compound, inverted, direct-acting type, and have cylinders 30 in. and 55 in. diameter, by 36 in. stroke, nominal horse-power 125, steam being supplied by a large boiler constructed for a working pressure of 80 lbs. per square inch. The working of the engines on the trial trip was most satisfactory in every way, and the mean speed, as taken on the measured mile at Withernsea, was 11·3 knots per hour.

The Rockton.—This vessel, built by Messrs. Napier, Shanks, & Bell, of Glasgow, and engined by Messrs. John & James Thomson, to the order of the Australasian Steam Navigation Company of Sydney, New South Wales, went down the Firth on her trial trip. From the Tail of the Bank she proceeded to Skelmorlie, where the measured mile was run. The ship, which is built for the Australian coasting trade, is 270 ft. long, 37 ft. broad, and 24 ft. deep (moulded), and has a gross tonnage of 2,000. She has passenger accommodation for 72 first and 80 second and third class. The vessel is fitted up with all the latest improvements to ensure comfort and convenience at sea. The engines are of the compound surface-condensing class, with two cylinders, and they worked up to an indicated horse-power of 1,882, and the speed developed on the mean run was about 13 knots per hour—a state of matters deemed highly satisfactory to all concerned.

Hypolite Worms.—On October 10th this steamer, lately launched by Messrs. Lobnitz & Co., Renfrew, went her trial trip on the Firth of Clyde, before taking up her station on the Bordeaux, Havre, and Hamburg Line of Messrs. Worms, Josse, & Co. On her runs from the Cloch to Cumbrae Lights, the distance was covered in one hour and eight minutes, giving a mean speed of 12 knots per hour, which is three-quarters of a mile per hour in excess of the speed guaranteed by the builders. The engines indicate 1-100-horse power. The *Hypolite Worms*, after her trial trip, proceeded at once to Havre.

Albano.—On October 10th, this steamer, built by Messrs. Aitken & Mansel to the order of the Atlas Steamship Company, made her trial trip, attaining a mean speed of 13½ knots per hour at the measured mile, which was considerably over what was expected. The vessel is 300 ft. long by 38 ft. beam, and has compound engines by Messrs. John & James Thomson, the cylinders being 38 in. and 72 in. by 51 in., and direct-acting capstan windlass, by Messrs. Emerson, Walker & Co., 11, Leadenhall-street, London. The *Albano* has, we understand, since changed hands, her new owner being the Marquis de Campo.

Ayrshire.—The s.s. *Ayrshire*, built by the firm of Messrs. Pearce Brothers, Dundee, to the order of Messrs. Pile, of London, for Messrs. John Smith & Son, of Ardrossan, went her trial trip down the Tay and along the Fifeshire coast to the Isle of May. Beautiful weather favoured the numerous company of ladies and gentlemen. The vessel started from the Docks at eleven o'clock sharp, and returned about six o'clock in the evening. A most enjoyable day was spent. During the trip luncheon was served in an excellent manner by Mr. Hume, of the *Oriental*. In the regretted absence of Mr. Alfred Pearce, the chair was filled by his son, Mr. R. A. Pearce, in a very happy manner. Mr. Boase Claverhouse, was croupier. After luncheon the usual loyal toasts were given. The croupier proposed "The Army, Navy, and Volunteers," to which Captain Pile, of the 2nd Northumberland Rifle Volunteers, replied. The Chairman then proposed the health of the contractors, Messrs. Pile, and the owners, Messrs. Smith. He said he had had every pleasure in working with them, and he hoped his firm's future contracts would be carried out in the same harmonious manner. They had endeavoured to turn out a first-rate ship, and if they had succeeded they were mainly indebted to the way in which the owners had received their suggestions. Mr. Pile, in replying, passed a high encomium on the work which the builders had turned out. In no boat could they expect to find perfect workmanship; still he could say from several years' experience that he had never seen a better finished boat than the *Ayrshire*. Mr. Smith junior, for the owners, said that in any future contracts his firm would not overlook the Messrs. Pearce. Indeed, so well satisfied were they with the *Ayrshire* that they would be disposed to give the firm a preference. The next toast proposed by the Chairman was, "Successs to the *Ayrshire*," which Captain Smith acknowledged, expressing the hope that the ship would be a profitable one. The following toasts were also given:—"The Town and Trade of Dundee," proposed by the Croupier and responded to by Mr. Sturrock, Lloyd's Surveyor; "The Ladies," by the Croupier, replied to by Mr. John F. Lee; "The Builders," by Mr. Kirkhope, Ardrossan, replied to by the Chairman; and "The Croupier," by Mr. R. A. Pearce. The vessel sailed remarkably well, the machinery working with great smoothness. In the course of the trip the measured mile was run, and the speed attained was 11 knots per hour.

Glen Dochart.—This fine vessel, which has been built by Messrs. Schlesinger, Davis & Co., of Wallsend, to the order of Messrs. McNabb & Young, of this city, had a satisfactory trial trip off the mouth of the Tyne. A large party of ladies and gentlemen joined the steamer before she left the builders' yard at 11 o'clock, when she steamed to sea direct, and was tried with gratifying results. A cold luncheon was served on board, after which Mr. Davis, the builder, proposed the health of the managing owners (Messrs. McNabb & Young), and said they were practical men, and likely to command a large measure of success in shipowning. Captain McNabb responded, and stated his satisfaction with the finish of the vessel, and expressed a strong hope of having another steamer ordered from the same builders forthwith. The healths of the shipbuilders, the engine builders, Captain Blance, the ladies, &c., were duly proposed. The *Glen Dochart* was brought to Jarrow Staiths, where she is now loading for Venice. The engines have been supplied by Messrs. Hawks, Crawshay & Sons, of Gateshead. The cylinders are 28 in. and 53 in. diameter, with a stroke of 36 in. to each, and during construction have been superintended by Mr. Walton, engineer, who was also on board during the trial.

Karaweera.—The large screw steamer *Karaweera*, recently launched from the yard of Messrs. Hodgson & Soulsby, Cowpen Quay, Blyth, having been built to the order of Messrs. Harrold Brothers, of London and Port Adelaide, had her trial trip. The steamer, which is of a splendid model and built on the two-deck principle, is of the following dimensions:—Length over all, 250 ft.; breadth, 35 ft.; depth of hold, 17½ ft. The vessel has a spacious poop aft, with bridge amidships and topgallant forecastle. She is fitted with tanks fore and aft for water ballast, and all the most modern improvements in iron shipbuilding, especially with those for the quick despatch in loading and discharging of cargo. The steamer is also fitted with four of Messrs. Chapman & Gurney's steam winches, and Messrs. Nichol & Donkin's steam steering gear. The vessel has been fitted with engines of 140-horse power, by Messrs. Blair, of Stockton, Her dead-weight carrying capacity is about 2,000 tons. The *Karaweera*, after having received her bunker coals at North Blyth, proceeded to sea at an early hour in the morning, and after the compasses had been adjusted by Mr. James Hood, Blyth, the trial trip was run, the vessel having steamed from a point off Newbiggin to Tynemouth Castle in one hour, being an average speed of 12 knots an hour. The engines worked without a single hitch whatever, and to the entire satisfaction of owners and builders. Amongst a large party on board were the following:—Mr. Harrold, of Port Adelaide; Mr. Donkin, of Newcastle; Captain James Hodgson, of Blyth; Messrs. Joseph Hodgson and Robert Soulsby, builders; E. Watts, jun., Mr. L. Towers, and Captain C. Marshall, the latter having superintended the construction of the vessel, and others. After the trial the steamer proceeded to London to load a general cargo for Port Adelaide. She is intended for one of the O.K. Line of trading steamers on the Australian coast. The steamer is commanded by Captain Blown. Luncheon was provided on board, and the usual toasts were given and responded to. The weather during the trip was thick and hazy, but everything passed off most successfully, the party being landed at Blyth in the evening by a steam-tug.

La Plata.—The steamship *La Plata*, the latest addition to the Royal Mail Company's fleet, was last week taken to Stokes Bay, under the command of Captain A. C. Green, for an official trial on the measured mile before being placed on the company's mail route between Southampton, Brazil, and the River Plate. Her leading dimensions are as follows:—Length 332 ft.; breadth of beam 40 ft.; depth of hold 33 ft.; gross tonnage 3,240; registered tonnage 2,969; and she is propelled by engines of 600-horse power nominal. She has accommodation for 180 first-class passengers and a large number of second and third class. She is provided throughout with all the latest improvements for comfort, ventilation, and speed. An average of four runs on the measured mile gave a mean speed of 13,539 knots an hour; pressure of steam 79 lbs.; vacuum 27 in.; revolutions 53 per minute. The vessel's draft of water was 16 ft. 3 in. forward, and 19 ft. 10 in. aft; and she had 768 tons of coal and 42 tons of water on board. The machinery worked smoothly and easily throughout the trial, and the performances of both ship and engines gave great satisfaction to the directors and other nautical gentlemen who were present.

Seraglio.—On October 14th, the *Seraglio* (s.) went down the Clyde on her official trial, and attained the speed of 11 knots with ordinary working. She left for London the same day, having been chartered by Messrs. Donald Currie & Co. to go to the Cape. She has been built and engined by Messrs. Robert Steele & Co., Greenock, for Messrs. Raeburn and Verel, Glasgow, and has Lloyd's highest class. Her carrying capacity is about 2,800 tons, and she has engines of about 200-horse power nominal. She is built on the three-deck rule, upper deck being iron, with topgallant forecastle, bridge, flying bridge, and house aft. She is fitted with water-ballast in both holds, four steam winches, steam windlass, steam stearing gear, lighthouses, &c.

Bow Fell.—On October 18th the *Bow Fell* (s), recently launched from the shipbuilding-yard of Messrs Murdoch & Murray, of Port Glasgow, for Messrs. Hume, Smith, & Co., of Liverpool, having had her machinery fitted on board, went down the Clyde on her trial trip. After proceeding to the Gareloch, and having compasses adjusted, she steamed to the measured mile to have her speed tried. The distance was run several times, and the speed ascertained to be 12 knots per hour. The engines worked with great smoothness and regularity; the whole machinery, which has been supplied by by Messrs. Dunsmuir & Jackson, Govan, Glasgow, giving entire satisfaction to the owners and their superintending engineer. This vessel forms the fourth of the Fell Line, and we understand that by the end of this month other three will be completed—one on the Clyde, by Messrs. Dunsmuir & Jackson; the other two, one of which carries 3,300 tons deadweight, at English ports.

Active.—The *Active*, iron corvette, cased with wood, having undergone a complete overhaul and repair of her machinery by Messrs. Humphrys & Tennant, of Deptford, the original constructors of the engines, made a three-hours' full power trial at Portsmouth, on October 18th, She has been fitted with new cylinders, a set of new boilers, and new turning and starting engines, while the condensers have been re-tubed and the feedpumps removed, and separate donkey feeds substituted. The *Active* is one of the swift but lightly-armed and unprotected cruisers which were built in 1869, when the depredations of the *Sumter* and the *Alabama* opened the eyes of the Admiralty to the risks which English commerce would run, in similar circumstances, from the attacks of guerillas. The *Active* and the *Volage* were constructed with the express object of protecting our mercantile marine from vessels of the *Alabama* class, and of driving an enemy's commerce from the sea. With this view they were built with fine lines and powerfully engined. The *Active* was provided with engines capable of developing 4,030 horse-power, while her displacement in tons was only 3,080. As she was not intended to take part in an engagement, or only when the advantage was clearly on her side, her armament consisted of 12 64-pounder guns, which would have been perfectly useless against a moderately armoured ship. This defect, however, is to be remedied, as it is intended for her to carry 10 of the new 6-in. breech-loading rifled guns on the broadside. The armament for the poop and forecastle is still in suspense. The steam trial, which was conducted by Mr. J. Ellis, Chief Inspector of Machinery, and Mr. Corner, of the Factory Steam Department, was very satisfactory. The mean pressure in the boilers was 29·8 lb., and the revolutions 76·93 per minute. In these circumstances, the engines developed a total horse-power of 3,784·63, while the ship realized a speed of not less than 14·7 knots an hour. Captain Colomb, of the Steam Reserve, was in command.

Noord Braband.—The s.s. *Noord Braband* which has been recently built by Messrs. Raylton, Dixon & Co.. of Middlesbro', for the mail service between Rotterdam and Java, left the yard of the builders on October 21st, on her trial trip to the Tyne. Her dimensions are: —length over all, 310 ft.; breadth, 40 ft.; depth moulded, 26 ft. 6 in., and she will carry a deadweight of 3,650 tons. She is built to the highest class of Lloyd's, has water ballast throughout on the "Cellular" principle, iron main deck covered with wood, and lower deck also partially laid, and upper decks of teak. She has a full poop aft for the accommodation of twenty first-class passengers, and second-class in forecastle, having accommodation for her officers, &c., in long bridge amidships. She is also fitted to carry troops between decks when required, and has ice-house, bakery, large galley fresh water condensers, and all the requirements of a passenger steamer. She is fitted with steam steering gear, direct acting steam windlass, wire hawsers, and all the latest improvements. Her engines of 250 horse-power nominal, are by Messrs. T. Richardson & Sons, of Hartlepool, giving a speed of nearly 12 knots on her trial trip to the Tyne.

TRIAL TRIP.—SWEDISH.

Kong Ring.—On August 29th, this vessel built by Kockums Mekaniska Werkstads Aktie Bolag, in Malmo, for the Sondenfjelds-Norske Dampskibs Selskab of Christiania, Norway, was successfully tried on the 12 knot course in the Sound. Her dimensions are 223 ft. long, 30 ft. beam, and 22½ ft. depth of hold. She is spar decked, built to Lloyd's survey 100 A 1, and is fitted to accommodate 30 first and 12 second-class passengers, provision being also made for the comfort of 200 emigrants. The saloon and first class berths are forward of the machinery space, and are fitted with every convenience, including electric bells and steam heating apparatus. The cargo capacity is about 1,000 tons. The engines supplied by the builders are of the usual compound inverted type, cylinders 31¾ and 55, stroke, 2 ft. 6 in. During a trial of four' hours duration, a speed of 11 knots was maintained, consumption being 187 lbs. per indicated horse power. a result in every way satisfactory. The *Kong Ring* then sailed for Christiania, to take her place on the line running from that port to Hamburg.

TRIAL TRIP.—GERMAN.

Rogaland.—On September 25th the s.s. *Rogaland*, built and engined by the Flensburg Iron Shipbuilding Company, to the order of Th. S. Falck, of Stavanger, make her trial trip over the measured distance in the Flensburg Bay. She is a spar decked vessel, and is of the following dimensions, viz.,—Length between perpendiculars, 212 ft.; breadth, moulded, 22 ft. 6 in.; depth of hold, 15 ft. 2 in.; and is built to 100 A 1 at Lloyd's. Her engines which are 85 nominal horse power were sufficient to drive her at a speed of 9½ knots an hour. The trial gave great satisfaction to all interested.

PATENT WRECK ESCAPE.—Many of our readers will be glad to learn that there is a probability of the wreck escape invented by Mr. J. R. Hodgson, "the Stormy Petrel" of life-saving fame, being exhibited in Sunderland shortly. It has attracted a great amount of very favourable attention at the Tynemouth Exhibition, and Mr. Hodgson has been earnestly pressed, before taking it to the south again, to bring it over to the locality where he earned his first distinctions in saving human life from drowning. The apparatus has won golden opinions from the most qualified judges, as the following testimonial from the coxswain of the Tynemouth life-boat of the Royal National Life-boat Institution will show. "Having tested Messrs. Timmis' & Hodgson's life-raft and storm-escape at Tynemouth about twelve years ago, I can speak with confidence as to its valuable properties. In testing it I placed as many men as could stand on one side, and this combined weight could not upset it; in fact it is hardly possible to capsize it by any force that is at all likely to be brought to bear upon it in action. Having been brought up as a sailor, and been over twenty years captain of the Tynemouth Lifeboat, I have had large experience in the use of life-boats, and yet have not seen so efficient a life-boat or raft. I have recently tested the models now in the Exhibition at the Aquarium at Tynemouth, and I am of opinion that it is not possible to sink or capsize the life-raft, as any seas that may break over it will pass harmlessly through. Its construction renders it perfectly safe from crippling injury by striking against any ship or rock.—(Signed) James Gilbert, Coxswain to the R.N.L.I., Tynemouth.

SHIPS BUILDING.

The shipbuilding firms in the Tyne last month have been fully employed in their various yards, and there is every prospect of an excellent and brisk trade for shipwrights and docks during the ensuing winter. Messrs. T. & W. Smith, of North Shields, have on the stocks a large new screw steamer which will be launched shortly. At Messrs. Palmers' yards at Howdon and Jarrow, men are well employed. Almost every berth is occupied with vessels under construction at these extensive works. The Tyne Iron Shipbuilding Company, Willington Quay, in addition to fitting out the screw steamer *Rennie*, recently built to the order of Messrs. J. Wait and partners, of North Shields, are building two more very large screw steamers. They are both at present in frame, and it will be close upon the end of the year before either is ready for launching. Messrs. Swan & Hunter, of Wallsend, have three steamers in progress of construction, and the keel is down for a fourth. Messrs. Schlesinger, Davis, & Co., also of Wallsend, have three steamers on the stocks, and they have just finished fitting out the new screw steamer *Glen Dochart*, which has been built under the supervision of Captain R. Blanch, of South Shields, for a new firm. At Messrs. Wigham, Richardson, and Co.'s yard, at Low Walker, the screw steamer *Lansdowne Tower*, for the Tower Line, is fitting outside the Neptune Engine Works. There are five vessels on the stocks at the same yard, one of them being only partly framed; some of the others are well advanced. Four new screw steamers are now on the stocks at Messrs. Readhead's yard at South Shields, and in addition the *Malta* is receiving her outfit in the same yard. The new screw steamer *Glenochil*, of Newcastle, is in the Middle Dock, South Shields, preparing to be surveyed for sea.

The port of West Hartlepool is increasing to a great extent. There have been 30 vessels launched this year, the number and the tonnage being larger than in any previous similar period, and exceeding the number and the tonnage launched in any preceding complete year, with one exception. Twelve vessels are now on the stocks, and four others are being finished. Throughout the whole of the present year and for several months into the next year there is abundant work for the shipbuilders at West Hartlepool, but new orders do not come to hand so freely as a few months ago.

New Ships for the Royal Navy.—According to returns officially prepared, it appears that during the past twelve months the Royal Navy has been increased by nine vessels of different tonnage and power, which have in that period been launched either from the Royal dockyards or by private shipbuilders, and that at the present time there are twenty-one others, either preparing to be built or under construction, some of which are in a forward state for launching. The vessels now being fitted for service, exclusive of the *Polyphemus*, which, although launched eighteen months months, is not yet ready for sea, include the composite paddle vessel of four guns, of 620 tons burden, and furnished with engines of 480 horse-power, built by Messrs. Westwood, Baillie, & Co., and named the *Alecto* (this vessel is now at Sheerness); the *Cordelia*, a screw corvette of steel and iron, cased with wood, sister ship to the *Canada* of 2,380 tons, and 2,300 horse-power engines, carrying ten guns, and built at Portsmouth, at which station she still remains; two composite screw sloops, each of 1,420 tons, with engines of 950 horse-power, each carrying eight guns, sister ships to the *Satellite*, launched at Sheerness a few months before, both built at Devonport, and named the *Heroine* and *Hyacinth*, where they still remain, the former being fitted out for service on the Pacific Station, where she will relieve the *Gannet*; three screw composite gunboats, the *Raven*, *Stork*, and *Starling*, each carrying four guns, and of 465 tons and 360 horse-power engines, built at Poplar by Messrs. Samuda, Brothers. The last named is now in service on the Cape of Good Hope station, having been commissioned in August last, the other two are at Sheerness. The last on the list of the vessels completed is the *Triton*, a paddle composite steam vessel of 410 tons, with engines of 370 horse-power; this vessel was also constructed by Messrs. Samuda, Brothers, at Poplar, and is now at Sheerness, in commission, commanded by Staff-Commander Thomas H. Tizard. Only two new vessels have been ordered to be constructed in the twelve months—viz., a double-screw steel armour-plated barbette ship, preparing to be built at Portsmouth dockyard; she is to be of 10,000 tons burden, to be fitted with engines of 7,500 horse-power, and to be named the *Camperdown*. The other, which is under construction at Pembroke Dockyard, is a twin screw steel armour-plated barbette ship of 9,600 tons, to be furnished with engines of 7,000 nominal horse-power, designed to carry ten guns, and to be named the *Howe*. The other vessels now in progress include two steel twin screw cruisers, armour-plated, each to be of 7,390 tons, and to have 8,000 horse-power engines, one building at Portsmouth, to be named the *Imperieuse*, and the other at Chatham, to be christened the *Warspite*; four double screw steel second-class cruisers, each of 3,750 tons burden, to be propelled by engines of 5,000 horse-power, each to be armed with ten guns, to be named the *Arethusa*, *Leander*, and *Phaeton*, building by Messrs. Napier & Sons, of Glasgow, and the *Amphion*, under construction at Pembroke dockyard; a screw corvette of steel and iron, cased with wood, designed to carry ten guns, of 2,770 tons, with engines of 3,000 horse-power, to be named the *Calliope*, and building at Portsmouth dockyard; three single-screw composite sloops, of 1,420 tons, with 950 horse-power engines, to be armed with 12 guns, and named the *Caroline*, *Rapid*, and *Royalist*, the first-named building at Sheerness, and the other two at Devonport; a double-screw steel armour-plated barbette ship, of 9,150 tons, and to be furnished with engines of 7,000 horse-power, to be armed with ten heavy guns, under construction at Pembroke dockyard, and to be named the *Collingwood*; this vessel is similar to the Howe, ordered to be built at the same dockyard, except that she is 450 tons burden less; three screw composite gunboats, of 560 tons each, and engines of 600 horse-power, building by Messrs. Laird, of Birkenhead, and to be named the *Albicore*, *Mistletoe*, and *Watchful*; a 14-gun steel single-screw corvette, of 2,770 tons, and engines of 3,000 horse-power, to be named the *Calypso*, and building at Chatham dockyard; a paddle-wheel composite vessel, of 1,130 tons, and engines of 1,000 horse-power, building by Messrs. Green, of Blackwall, to carry seven guns, for service in the Persian Gulf, and to be named the Sphinx; two screw composite gun vessels, of 925 tons each, and 750 horse power engines, to carry three guns each, building at Middlesbrough-on-Tees, by Messrs. R. Dixon & Co., and to be named the *Dolphin* and *Wanderer*; and a double-screw steel armour-plated barbette ship, of 9,600 tons burden, and to be furnished with engines of 7,000 horse-power, sister ship to the *Howe*, ordered to be built at Chatham dockyard, to be armed with ten heavy guns, and to be named the *Rodney*.

Shipbuilding for France.—Since the introduction of the law in France by which all vessels employed on the *long-cours* receive a premium on the distance sailed, nearly all the shipowning companies have added largely to their fleets, and many new steamship companies have been formed. The French shipbuilding companies have not been able to produce the tonnage required, although the premiums in favour of French-built vessels give the latter a great advantage over vessels built abroad, and the French shipbuilders have obtained a much higher rate for their tonnage than their British competitors. The great majority of high-class steamships built abroad during the last few years for French account have been produced on the Clyde, and several of the yards in that district have now contracts on hand for our neighbours. Although the bounty system has been the means of largely increasing French tonnage, some of the enterprising companies, whose vessels are not engaged in the *long-cours*, have added considerably to their tonnage, notably, the celebrated Fraissinet Company of Marseilles. This company have recently added 16,000 tons of British-build steamers to their line, six of which vessels have been built by Messrs. A. M'Millan & Son, Dockyard, Dumbarton.

* ON MODERN MERCHANT STEAMERS.

By James Dunn.

During the last few years I have been brought, in the course of my official duties, into constant communication with the owners and builders of the merchant ships of this country. And it has been suggested to me that, without disclosing any information respecting individual ships which has been obtained for the confidential use of the Admiralty, and without in any way drawing conclusions which might erroneously be looked upon as official, it might yet be of service to you if some of the facts concerning modern steamers which I have in the last few years acquired were brought before your notice in the present form.

In the period of which I wish particularly to speak, there have been changes in our mercantile marine which must be within the knowledge of every person who is in any way brought into contact with shipping matters, or, indeed, of any intelligent reader of the daily newspapers. But there have been other changes, which, though perhaps but partially known to you, and almost unknown to the general public, may yet prove to be of the highest importance.

Of the general effect of these latter changes I do not propose to speak. It will be sufficient for me to place before you, in as simple and complete a form as possible, of what these changes consist; and I do not doubt that from them the members of this Institution will be able to draw, far better than could I, conclusions of interest to themselves and of benefit to the country.

The changes in our mercantile marine from sail to steam, from wood to iron, and, to a less extent, from iron to steel, are, I say, known to every one.

And equally evident is the growth of our commerce and carrying trade, both in absolute magnitude, and in relation to those of other nations. But it is very difficult to realize how great these changes have been.

In 1850, only 12 per cent. of the effective tonnage (*i.e.* carrying power) of our merchant navy was steam tonnage; in 1880 the steam tonnage amounted to 62 per cent. While the carrying power of our sailing ships had increased less than 60 per cent. (which increase, moreover, occurred almost entirely in the first ten years of this period), the carrying power of our steamers had increased 1750 per cent.

For several years past there has been a general diminution in the number of sailing ships owned and employed by this country. This diminution has occupied in sailing ships of all sizes with one striking exception. There has been an increase of about 50 per cent. in sailing vessels of 1400 tons to 2000 tons, and as sailing ships of this, the largest size, are still being extensively built for the White Star and other large firms, it seems likely that it will for some years be possible to economically use such vessels on long distance trades. With this solitary exception, the transfer, first of the general passenger trade, and later on of the general cargo trade, from sail to steam is now nearly complete.

As regards the material of which our ships are built; in 1880 only 20 per cent. of the tonnage built in the British Empire was wood, and less than 5 per cent. of the tonnage built in the United Kingdom.

But this change from wood to iron appears to be a step and nothing more. Iron is being replaced by steel in the same way.

There were 21,000 tons of steel shipping built in 1879, 36,600 tons in 1880, and 45,000 tons in 1881. We have had the efficiency of steel steamers very thoroughly discussed by Mr. Denny and the east coast shipbuilders; and there seems little doubt that in the long run the question will be generally decided in favour of the best material.

Then, as to the work done by these ships; the entrances and clearances of British ships in the foreign trade at ports in the United Kingdom increased from 9½ millions of tons in 1850 to 41½ millions of tons in 1880, being about 540 per cent.; and whereas in 1850 one-fifth of this tonnage was steam, in 1880 steam formed three-fourths.

Other countries have largely increased their trade and shipping during the last thirty years, but not at so great a rate as this. The carrying power of foreign nations has increased by 250 per cent.; but ours by 380 per cent.

The value of British shipping is now estimated to be one hundred and fifty to two hundred millions sterling.

Remarkable progress has been made in certain trades. Take the direct trade between England and the Atlantic ports of the United States. From 1850 till 1862 two-thirds of this trade was done by American shipping. In 1865 the American share had fallen to one-quarter of its amount in 1862; and in 1880, although the gross trade is three times as much as it was in 1850, only one-fourteenth of this trade was done in America, and seven-ninths in British vessels.

Take, again, the East India trade. The trade carried on by foreign vessels is about the same as it was twenty-five years ago, but the trade in our own vessels is seven times as much as it was then.

Over four-fifths of the tonnage passing through the Suez Canal is British. I may notice, incidentally, that the size of the steamers using the Suez Canal increases very slowly. Between 1874 and 1880 the total tonnage passing through doubled; the average tonnage only increased about ten per cent. although in the meantime a large number of very large vessels had been built expressly for the work. There is, of course, the limitation of draught, but it is more likely that the large new steamers are swamped by the great number of smaller cargo steamers lately sent through the Canal, on account of slackness of trade in the Black Sea and Mediterranean.

Looking to the immediate future, we may reasonably anticipate that we shall retain our share of the carrying trade of the world. Each change of the conditions of trade appears to operate in our favour. Goods as well as passengers are now carried in steamers, and more and more in large steamers. Every effort is made to decrease the time as well as the cost of transit. And this seems likely to be best effected by continuing to increase the size and speed of general cargo steamers. The increase of size, and the transition from sail to steam, takes place more rapidly in British than in foreign vessels. We have the great advantage of building all our own steamers, and 60 to 70 per cent. of the foreign steamers. And so we are likely for years to come to have the benefit in peace, and the responsibility in war, of most of the carrying trade of the world being conducted under our flag.

The above figures set forth, what you will all agree to, that our trade and shipping have wonderfully increased during recent years. It appears, moreover, to be agreed by all—all, at any rate, whose remarks I have read or heard of—that this great trade will be a very vulnerable point in any future war. That opinion has been very strongly put by American naval authorities, and it was evidently the relief of the Russians in 1878. I am extremely anxious to avoid offering any speculations of my own upon this subject; they would be of small intrinsic value, and they might be misconstrued. But the opinions and conclusions of those among you who are best able to speak with authority will be necessarily founded on a full enquiry into an acquaintance with the facts of the case. Such an enquiry would embrace not only the extent of our merchant marine, our over-sea food supply, and our foreign and colonial trade, but also the resources which are available to defend these interests.

It would, therefore, include a knowledge as to what part of our regular Navy would, after reserving sufficient strength for home defence, and for opposal of such hostile fleets as we might fairly be expected to meet, be at the disposal of the Government for this special work, and of its fitness for performing it. It would include an estimate of the extent to which, if necessary, this force may be increased, and, when required, manned. It would further include a knowledge of the extent, if any, to which merchant steamers could be used for their own defence, or the defence of their fellows; of their individual fitness; and of the number available for such work.

I do say that these, and these only, are the facts with which you should be familiar that you might pass a sound opinion on the question; but looking to the fact that it has on the one hand been held desirable to very largely increase our Royal Navy, under the belief that merchant steamers are unfit for fighting, and that, on the other hand, it has been thought that merchant steamers would make such excellent cruisers, that the existence of such a class in the Royal Navy is unnecessary, I imagine that it is not presumption on my part to say that a full inquiry into the above matters is necessary, that you may form a reliable judgment on the general question of the defence of British interests on the ocean.

It is unfortunate that, while the opinion that the cruising vessels of the Navy should be multiplied in number to meet these requirements seems to be sometimes held, no detailed scheme for providing and maintaining such fleets, or for manning them when they were provided, has been presented to the public by the supporters of this view. And pamphlet writers generally confine themselves to depreciatory remarks as to the cost, the slowness, and the limited coal supply of our regular cruisers.

I am unable to put before you, therefore, any information on this side of the question; but I have seen very much of merchant steamers during the last six years, and during that time many changes have occured, which, though they have mostly come about for strictly commercial reasons, have undoubtedly affected, in a remarkable degree, their capabilities for modern fighting. To these changes your attention is now asked.

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* *Read at the Twenty-third Session of the Institution of Naval Architects.*

First, take the question of speed. We are principally interested with vessels of the highest speeds and of considerable coal-carrying power. Between 1875 and 1882 the number of steamers having ocean speeds of 13 knots and upwards has increased from twenty-five to sixty-five. Of those, there were only ten of 14 knots speed and upwards; now there are thirty-five. The highest speed was then 15 knots; now we have several steamers with speeds approaching 17 knots.

This increase in speed of many first-class steamers is all the more important because the average speed of merchant steamers has not advanced at a corresponding rate.

Take, again, the question of coal endurance. The gradual improvement of marine engines has brought about a considerable increase in the power of cruising or steaming for long periods without recoaling. The effort made to secure economy and success in mercantile trade has directly increased the fighting power of merchant steamers. We have now many steamers which can carry sufficient coal to steam round the world at a 10-knot speed; and these steamers are of moderate dimensions. There are ten such vessels on the Cape Mail service, and four others building. None exceed 380 ft. in length.

In a lesser degree the fighting value of merchant ships has been effected, in that their structural strength has considerably increased. This has been largely due, in the matter of longitudinal strength, to the investigations made during the last ten years, and communicated to this Institution, and to the great care of Lloyd's surveyors. The improvement in the quality of iron and in the modes of working, the use of steel, the introduction of double bottoms, and the more general employment of complete iron and steel decks, have all helped in this direction.

The question of structural strength has frequently been raised when proposals have been made to fight guns in merchant steamers. The Admiralty Committee of 1852 thought that they would require strengthening, and doubts as to their strength have been expressed in this Institution. A direct experiment, however, was made in 1878 on this point. The Admiralty purchased the *Hecla*, then building at Belfast for the Atlantic trade. Without any additional strengthening she was armed with five 64-pounders and one 40-pounder, on truck carriages, and such fittings and stores as would be supplied to merchant steamers were placed on board. The vessel was then sent on a trial cruise with a complement of officers and men from the Royal Navy. Admiral Boys and the officers reported very favourably of her, and although she was not so handy as the ships to which they were accustomed, and as are other shorter vessels in the merchant service, the experiment was a decided success. The *Hecla* has been in commission ever since.

(*To be continued.*)

THE *Devastation* concluded her various experiments last week, and came into harbour. The principal purpose of the experiments was to test the value of a new pull-out hydraulic buffer, for checking the recoil of heavy guns on board ship, previously to its being fitted to the guns of the *Thunderer* at Malta. There are at the present time two kinds of frictional and four kinds of hydraulic compressors in use in the Navy, each of which has its special advantages and disadvantages. A perfect compressor has been defined as fulfilling the following conditions:—It should come gradually into action, so that everything in the nature of a blow on the carriage or working parts may be avoided, the resistance offered should be low and nearly constant, it should be capable of adjustment for any length of recoil, it should be automatic, and should hold the carriage when the ship is rolling, without interfering with the running in and out. None of the buffers now in use fulfil all these necessary conditions, and the recent trials of the new and improved one tend to prove that the perfect monster has yet to be invented. The turrets of the *Devastation* carry each two 35-ton M. L. R. guns, and the test consisted in firing five battering charges of 110lb. and projectiles weighing 698lb. from each gun. The firing began as soon as the ship got outside the Nab. As far as the experiments in the fore turret were concerned, the results were deemed tolerably satisfactory, though the nicety with which the oil in the cylinders required to be adjusted and maintained was deemed a disadvantage. During the firing from the after turret, however, the guns rebounded with great violence, and did some little damage to the buffers. The firing was taken advantage of to ascertain the effect of the concussion upon the lamps and attachments of the electric light. With this object in view, 22 lamps, some alight and others unlighted, and consisting of the Swan, Edison and Maxim types, were placed inside and around the turrets, four of the Swan lamps being fitted over the breeches of the guns. It was also intended to test the effect of the firing upon a powerful search light, which had been fixed upon the superstructure deck. Unluckily, as soon as the lamp was put in circuit the glass face was broken by the intense heat, and the carbons, being unprotected, were destroyed by the fourth round. At the third round, a Swan lamp, one side of which had been accidentally broken, was completely smashed; while at the fifth round, the springs by which a second Swan lamp was suspended were injured, and allowed the interior globe to fall upon the outer globe and extinguish the light. Both these lamps were fixed outside the turret. The other lamps withstood the shock of the guns without injury. The subsequent experiments were undertaken for the purpose of ascertaining the effect of discharging Whitehead torpedoes from the stern and between the races produced by the twin screws of a ship under way. Three buoys were dropped as targets, one being 70 yards to the northward, and the other about 100 yards to the southward of the centre buoy. The runs were made at a range of 500 yards and upwards, the engines going at about 30 revolutions. The results of the practice, like all other torpedo trials under way, were not satisfactory. The projectiles were observed to go straight for a short distance, but they then became diverted either to the right or to the left, and never got near the target they were aimed at.

A MISSIONARY STEAMER.—The Baptist Missionary Society, in pursuance of their labours in Central Africa, have met with almost insuperable difficulties in the way of penetrating to the vast tract of country bordering the upper reaches of the Congo, the great natural waterway into the heart of Africa. The main difficulty seems likely to be solved by the construction of the steam-launch *Peace*, which was yesterday moored off the Thames Embankment, near St. Thomass's Hospital, and after remaining for inspection until to-morrow, will steam back to the yard of Messrs. Thornycroft & Co., at Chiswick. There it will be taken in pieces and shipped to the mouth of the Congo, whence it will be carried piecemeal to Stanley Pool, and, after reconstruction, launched upon the broad waters of the Congo to carry out the work for which it has been thoughtfully designed and skilfully built. The vessel is not much to look at, but is admirably adapted for the work she will have to do—namely, that of conveying missionaries and the stores necessary at mission-stations from place to place on the banks of the Congo itself and of its many tributary streams, where occasionally the water is shallow, the rapids frequent, and the stream at the best somewhat difficult of navigation by reason of floating timber and other obstructions. The boat is 70 ft. in length, or about 30 ft. longer than that in which Mr. Stanley made his way to the lake which bears his name. It is propelled by twin screws, experience having shown that screws are preferable to paddles in waters where drift wood is likely to be met with. The propelling screws are of a type which will diminish the draught of water of the craft, and they have this additional advantage—that by means of an ingenious detail in construction one screw can continue working while the other is being cleaned in the event of its having become choked with weeds. With a vessel which has to be built and then taken to pieces and reconstructed, it is, of course, important that the component parts should be of handy weight. This has been so far successfully accomplished that, with the exception of the boiler, there are only one or two pieces which exceed the weight one man may conveniently carry. The engines have shown themselves satisfactory, having been put to the test over a measured mile in the presence of high authorities, and little doubt is felt of their ability to force the little craft through the more than 2,000 miles of the Congo River and its many tributaries which yet remained to be explored. It is expected that the dismembered craft will leave for the mouth of the Congo River early in December, and after that those who watch its progress must wait patiently for a long time—probably close upon a year—before they hear of its having started from Stanley Pool on the mission for which it is intended. The necessary funds for the building and equipment of the vessel have been provided by Mr. R. Arthington, of Leeds, a very liberal promoter of African mission work, and a further considerable sum has been subscribed by him for investment as a maintenance fund. The gentlemen who are engaged in the Congo mission look upon the launch of the *Peace* as being likely to produce good results in introducing and propagating religion in the heart of Africa, and also in opening new markets and extending trade to the great advantage of England.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

September 23rd, 1882.

Adolphsen, A. P. C.	2 C	London.
Baillie, William	2 C	Glasgow.
Birrell, Wm. A.	2 C	Hull.
Brown, Alex.	1 C	Glasgow.
Bunce, William	2 C	London.
Carswell, Robert	2 C	do.
Carten, James,...	1 C	Hull.
Christensen, Carl C.	1 C	N Shlds.
Crawford, Wm.	1 C	Glasgow.
Davidson, Jas.	1 C	do.
Duncan, John...	1 C	do.
Escott, W. G....	2 C	London.
Fettes, James ...	1 C	Dundee.
Forrest, John ...	2 C	Glasgow.
Geldsetzer, I. P. H.	2 C	N Shlds.
Gibbs, Alfd. W.	1 C	London.
Gilmour, John...	1 C	do.
Hart, James ...	2 C	do.
Harvey, James	2 C	do.
Hewitt, Frank J.	2 C	do.
Hugill, Thomas	2 C	N Shlds.
Hunt, Edward	2 C	London.
Leach, George...	1 C	do.
Macdonald, Jno.	1 C	Glasgow.
Macfarlane, Jas. L.	1 C	do.
Mantle, J. G. C.	2 C	London.
Matthew, J. P.	1 C	do.
McCracken, Thos.	1 C	Glasgow.
McKenzie, Hugh	1 C	London.
McNeid, John ...	2 C	Glasgow.
Merrilees, Rbt.	2 C	do.
Morriss, Charles	2 C	London.
Morton, John ...	2 C	do.
Paterson, John	1 C	do.
Paterson, Roderick ...	2 C	N Shlds.
Perkins, Thomas	1 C	London.
Potts, Robert ...	1 C	Glasgow.
Rewcastle, John	1 C	do.
Roberts, Wm.	1 C	do.
Robertson, John	2 C	do.
Sinclair, George	1 C	Aberdn.
Swinburne, J. S.	1 C	London.
Theyer, Samuel H.	2 C	do.
Tricker, Chas. H.	1 C	do.
Wilson, David...	1 C	Glasgow.
Younger, George	1 C	do.

September 30th, 1882.

Barker, John ...	1 C	N Shlds.
Blokeman, John	2 C	do.
Brough, Lowther	1 C	Lvrpool.
Cain, Thomas A.	2 C	do.
Clark, James ...	2 C	do.
Cornelius, E. J.	2 C	London
Cowdell, Hny. C.	2 C	do.
Craig, James ...	2 C	Dundee.
Crelley, John ...	1 C	Lvrpool.
Cruden, David	2 C	Glasgow.
Daglish, James	2 C	N Shlds.
Davidson, Alex.	2 C	Glasgow.
Duff, Andrew N.	2 C	Lvrpool.
Elders, Henry ...	2 C	N Shlds.
Gilmour, Rbt.	2 C	Lvrpool.
Hamilton, W. L.	2 C	do.
Hardy, Thomas	2 C	Bristol.
Haswell, George	1 C	N Shlds.
Howat, Robert	2 C	Lvrpool.
King, Alfred ...	1 C	N Shlds.
Lyon, A. ...	1 C	do.
Marshall, Rbt.	2 C	Glasgow.
Marshall, John	2 C	do.
McHutchison, S. A.	1 C	Grnock.
McDonald, W.	1 C	N Shlds.
Morrison, R. ...	1 C	Glasgow.
Murray, Wm.	1 C	Sndrlnd.
Newton, M. F.	1 C	N Shlds.
Nisbet, E. C. ...	1 C	London.
Oates, Thomas	1 C	Lvrpool.
Ross, Henry W.	2 C	do.
Rowan, James	2 C	Glasgow.
Rushmer, John	2 C	Sndrlnd.
Sinclair, A. ...	1 C	Glasgow.
Stobbart, E. ...	1 C	N Shlds.
Tetley, Geo. S.	2 C	London.

October 7th, 1882.

Banks, Harry ...	2 C	London.
Beels, Benjamin	2 C	Hull.
Burnett, Alex.	1 C	Aberdn.
Carreras, Peter	1 C	London.
Cathcart, Chas. A.	2 C	Leith.
Cook, Geo. P.	2 C	Hull.
Davids, Smith W.	1 C	London.
Dodson, Wm.	2 C	N Shlds.
George, Robert	2 C	London.
Gurney, William	2 C	do.
Hay, James ...	1 C	Grnock.
Hood, Chas. J. H.	1 C	Leith.
Lennox, Peter ...	2 C	London.
MacDonald, J.	E 1 C	Glasgow.
McInnes, K. ...	2 C	London.
McLean, Arch.	2 C	do.
MacMaster, Wm.	2 C	Belfast.
Pitcher, Wm. H.	1 C	Plmouth.
Ross, William...	1 C	Leith.
Scott, Fredk.	E 1 C	Swansea.
Smythe, James	2 C	N Shlds.
Tremellin, John T.	1 C	London.
Wood, Alex. D.	1 C	Leith.
Wood, George	1 C	do.
Worrall, Alex.	2 C	do.

October 14th, 1882.

Blair, John ...	1 C	Glasgow.
Brownfield, M.	2 C	London.
Cameron, Donald	1 C	Glasgow.
Crawford, John	2 C	do.
Fletcher, James	2 C	do.
Fletcher, Jno. R.	1 C	N Shlds.
Fox, Jno. Young	2 C	Grnock.
Goudie, David...	1 C	Glasgow.
Hawthorne, Neil	2 C	do.
Hillhouse, Wm.	2 C	do.
Houghton, R. J.	2 C	Lvrpool.
Johnston, Geo.	2 C	Glasgow.
Jones, Hugh ...	1 C	Lvrpool.
Kercheval Y. Y.	1 C	London.
Kitchin, W. B.	1 C	Lvrpool.
Link, Wm. E....	2 C	Cardiff.
Matthews, Benj. C.	2 C	London.
McAllister, Wm.	2 C	Glasgow.
Robertson, John	2 C	Leith.
Sells, C. de Grave	1 C	London.
Simpson, Josh. E.	2 C	W. Htpl.
Stephens, Rbt.	2 C	Cardiff.
Taylor, Andrew	2 C	Glasgow.
Taylor, Geo. F.	1 C	N Shlds.

October 21st, 1882.

Clarke, Arnold T.	2 C	Lvrpool.
Cliffe, William	2 C	N Shlds.
Dowey, Chas. T.	1 C	do.
Foggan, John ...	1 C	do.
Greenaway, Frederick ...	2 C	London.
Hewitt, Allan G.	1 C	Lvrpool.
Hutchinson, Jno.	2 C	N Shlds
Jepson, Joe ...	2 C	Hull.
McEwan, Hny. D	1 C	London.
Stewart, Robert	2 C	Lvrpool.
Stutt, William	1 C	Hull.
Wylie, John. ...	1 C	Lvrpool.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from 21st September.

4519 J. Leather & J. K. Leather. Saloons and cabins.
4526 B. C. Le Moussu. Preventing shocks to ships at anchor.
4533 J. Scott. Construction of ships' anchors.
4552 A. B. Rodyk. Coating ships' bottoms.
4559 T. Gilmour & J. Gilmour. Steam boilers.
4556 B. Fowler & W. Daniel. Governors.
4575 R. Gibbs. Propellers.
4577 H. M. Whitehead. Appliances for stowing.
4578 W. H. Wood (communicated to W. Clark). Dredging buckets.
4583 F. M. Roots (communicated to M. Benson). Pumps and blowers.
4585 B. W. Maughan & S. D. Waddy. Marine navigation.
4588 T. Allison. Water gauge taps.
4606 W. Richter (communicated to J. H. Johnson). Vaccum pumps.
4609 R. H. Tweddle & J. Fielding. Apparatus for portable rivetting machines.
4621 N. A. Bonneford (communicated to W. R. Lake). Slide valve and mechanism.
4626 P. B. Elwell. Governors.
4632 J. W. Couchman. Steam boilers.
4634 A. J. Fenn. Steam boiler furnaces.
4637 E. J. Harland, G. W. Wolf, W. H. Wilson & W. J. Pirrie Steering gear.
4638 M. M. Monsanto, B. Odio, & F. Perozo (communicated to W. P. Thompson). Steam furnaces.
4647 R. C. Thompson. Side lights, manhole doors, &c., fastenings.
4655 R. Hudson. Metallic staircases.
4669 M. Hervier (communicated to W. Clark). Steam generators.
4721 C. P. G. Sack (communicated to G. F. Redfern). Steam boilers.
4736 J. Roberts & G. Travis. Preventing radiation of heat from steam boilers, &c.
4753 J. H. Davis. Diving apparatus.
4764 A. Reekenzaun. Electrical apparatus for boat propulsion.
4774 H. C. Bull. Steam generation.
4782 W. S. Brice. Elevators.
4797 C. A. & R. C. Parsons & J. H. Kitson. Steam engines.
4804 R. Smith. Propellers.
4807 J. H. Milligan (communicated to W. R. Lake). Self-levelling berths.
4820 W. F. Thompson (communicated to A. M. Clark). Tube stopper.
4821 C. G. Viehoff (communicated to C. D. Abel). Transport of vessels.
4840 W. Teague. Fresh water supply.
4899 T. Nordenfelt. Machine guns.
4910 S. Elson & V. Eastwood. Fuel economizers.
4926 F. H. Poore. Range-finders.
4946 J. C. Brentnall. Steam furnaces.
4957 G. G. M. Hardingham. Steam boilers.
4969 W. Allam. Marine engines.
4976 R. E. Melsheimer. Ships' binnacles and compasses.
4978 A. W. Robertson. Feed Pumps.

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NOTICE.

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The Subscription to "The MARINE ENGINEER," payable in advance, is (including postage) Five Shillings per annum.

The Marine Engineer.

LONDON, DECEMBER 1, 1882.

EDITORIAL NOTES.

THE sinking of the *Austral* in Sydney Harbour is a unique accident of its kind. The *Austral*, as will have been learnt from our detailed description of the vessel in our June number, is constructed on the most improved principles so as to be rendered, as far as possible, unsinkable at sea. The more startling then is the accident that has caused her to founder in a perfectly calm harbour. We think the accident may be ascribed, without much doubt as to its correctness so far, to the displacement of her centre of gravity whilst coaling, and consequently causing her to "turn turtle" and founder. The only matter of supposition and doubt is how it can have happened that such carelessness can have been used to cause a sufficient want of stability as to allow her to turn over. We fear that in the first place this arises from the comparative want of realization on the part of sailors as to how easily a modern built vessel can turn over, and that it is only owing to a judicious distribution of weight that they are ever kept floating erect. Sailors, we imagine, as a body, are so accustomed to seeing vessels float upright as a matter of course, that they do not realize the small margin between safety and danger exists in every vessel, particularly when floating light, and that but for the ballast the vessel has more tendency to float bottom upwards that any other way. We should suppose in this particular case that the water ballast had being partially removed, leaving an exceedingly dangerous mobile ballast when the tanks are half full, which will follow any list of the ship instead of helping to rectify it. If then under such conditions the coal, of which about 1,500 tons had been taken on board, was stowed any how, a considerable and gradually increasing list of the vessel would be produced. As the moving water ballast would follow this list, the angle of stability of the vessel would be very small, and no doubt the vessel had been perilously near that angle for some time, without any alarm being occasioned in the minds of those in charge. As it is the last straw that breaks the camel's back, just so it would be the last ton of coals on the loading side which listed the vessel just over the angle of stability. She would then heel with a rush, and the coal ports being open, she would fill and go down in a minute or two. We cannot suppose that the entry of the sea into the coal ports was the primary cause of the accident, as in such case the list would have been gradual up to that point, and would have given due warning. The dipping of the coal ports beneath the surface must have been sudden, or it would have been foreseen and prevented, and for this to be so the angle of stability must have been passed by the absence or movement of the water ballast, and the want of storing of the coal as delivered. An instrument which would indicate the stability, that is, the resistance to listing of a vessel, whatever the change in its loading and ballast, would be a grand discovery could such be made. We recommend the idea to our inventive readers.

If we are to believe contemporary journalism in America, the rating of vessels for sea-going efficiency is what we should here consider a farce. A nautical journal speaks of "the rating of vessels based on the whims, ignorance, or greed of irresponsible surveyors, who publish a survey book for gain, and who demand a monied consideration for giving a vessel a character, which really is valueless, so far as the sea-worthiness of the vessel is concerned." This journal even goes so far as to state that the book-character of a vessel in the States entirely depends upon the amount of money paid to secure a rating, and that it can produce facts to prove that vessels have been raised from A 2½ to A 1 for the sum of $50 and even less. These are statements of very grave import, and we cannot imagine what the underwriters and insurance companies are about, not to insure proper impartiality and integrity in the reports. We do not know whether it is the habit of any English underwriters or insurance offices to take risks in American bottoms on an American Register, as freely as on our Lloyd's Registrar, but if so the foregoing hint, as taken direct from their own published statements, may be of value to them. The said journal further states that they know cases "where owners have paid fees for inspection of vessels under construction, when the surveyors were never seen in or about the vessel they certify to be A1 in every respect." We wish them speedy reformation.

We have a word of warning to vessels trading to New York and other parts on the east coast of the States. Through excessive competition the pilots off those ports are given to cruising one to two hundred miles off shore, and not being good navigators, except by landmarks, they are very often a great source of danger to fast steamers from over-ruling or influencing the better knowledge of the captain. The Hamburg steamer *Vandalia* has had a recent narrow escape from stranding on Deal Beach, N.J., whilst in charge of a Sandy Hook pilot, and we find that records show that a majority of vessels stranded on the coasts of Long Island and New Jersey in years past have been in charge of pilots. If the captains would combine not to encourage the cruising of pilots further out than a reasonable position where their services are required, this abuse could soon be stopped, and at the same time the certainty of finding a pilot when required would be increased by the restriction of the cruising area.

We see that Mr. Jabez James, in conjunction with Mr. Walter Wardrope, have patented a very useful form of three-cylinder engine which are now so much in vogue for driving launch propellers, or other fast machinery. The engine in question has the usual three cylinders arranged at equal angles around the crank-shaft, and single-acting by compression only, the live steam operating between the piston and outer cover, the inner part of the case receiving the exhaust. The special peculiarity of the engine is the arrangement of the valves, which are cylindrical, thus making all the fitting, boring, and turning. The valves are open and in equilibrium, the steam admission being regulated by a recessed pocket in their sides. They are moved by connecting-rods of considerable length, operated from the adjoining pistons. The cut-off and action of the valve is therefore that of an ordinary D slide-valve. There is a special exhaust-port provided through the walls of the cylinders, which are uncovered by the pistons when they have completed about five-eighths of the stroke. The exhaust is liberated through these ports to the central casing, helping to lubricate the work parts, and is thence carried off by an exhaust-pipe in the usual way. The whole arrangement is very simple and compact, and has the great economical advantage of giving the least possible clearance in the steam ports, as these latter are only the depth of the cylinder wall.

The proposed new American Company of fast liners, that we have before referred to, are basing their project upon an entirely new departure in the lines of their steamers for speed with broad beam and maximum carrying capacity. They expect to put steamers on the line to run at twenty to twenty-one knots an hour with a moderate expenditure of power. The prominent idea in the new steamers is to make them flat-bottomed, rising fore and aft, to make the hulls divide the water horizontal rather than vertically. With a breadth of 58 feet on load-water line, a draught of 23 feet, and a length over all of 475 feet, they obtain a displacement of 10,881 tons, and propose to engine such a vessel up to 18,000 indicated horse-power with twin propellers. The vessel is expected to carry about 600 first-class and 1,000 second and third class passengers, and 3,000 tons of cargo. The propellers are to be carried by the spur of the projecting stem beyond the rudders, of which there are two, and which are balanced on a central rudder-post. The hull is widest at the bilge or lower hold, above which the sides recess inwards in a considerable curve, and project outwards again above water-line. This will, at any rate, make the vessel exceptionally steady at sea, and give her enormous stability, even without much ballast. This is evidently a startling experiment, and ought to be watched with great interest by shipowners and builders, as we must not forget that some of the fastest yachts and slave schooners have come from American yards.

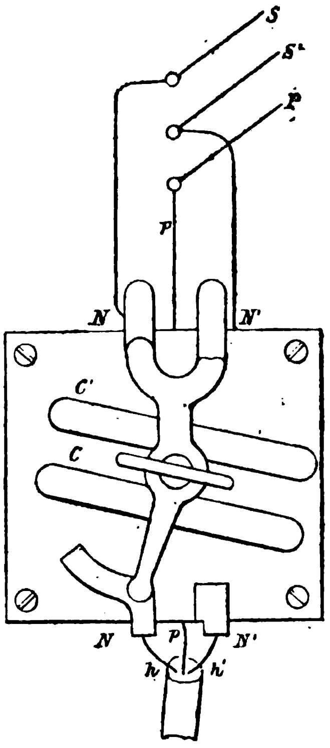
ELECTRICITY AND ITS MODERN DEVELOPMENTS, WITH SPECIAL REFERENCE TO MARINE ENGINEERING.

(Continued from page 213.)

THE lighthouses in France are managed by two public departments, the "Services des Phares de France," and the "Ministére des Travaux Publiques." Quite contrary to the result which such an arrangement in this country would lead us to expect, we find the heads of these departments instant in season and out of season in urging the adoption of every new invention and first-class improvement. It is recognized that expense, in a question such as this, is but a secondary consideration to efficiency, and that efficiency must not be taken as a relative quality but absolutely. A light 50 per cent. more efficient, even though it cost three times the money (which would be deemed by our rigid political economists only half as good) is the best, and must be adopted. We by no means intend to suggest for a moment that even in this limited sense the electric light is for the purpose under consideration in any respect inferior to coal gas, oil, or candles; indeed, the figures we shall quote prove quite the opposite. But we do say that the action of the French authorities in adopting novelties, while yet their sterling merit and striking pre-eminence remain to be proved, is a course very different from what we are wont to associate with our own Governmental Grandmothers.

The French Officials have been well supported by those private firms, who until within the last two or three years could claim for France the honour of having nursed from infancy to manhood the electric light. Foremost amongst these is the well-known house of Messrs. Sautter Lemonnier. So far back as the Paris Exhibition of 1878 they exhibited a complete apparatus for a first-class electric lighthouse, of which we extract a condensed description showing the high pitch of excellence to which the optical arrangements for the use of so powerful a luminary had been brought. The apparatus consisted of a fixed lenticular "bee-hive" apparatus, about 30 in. in diameter, illuminating an arc of 300 deg. of azimuth, and surrounding a large Serrin regulator, to which an electric current was supplied by a Gramme machine. Around this "bee-hive" revolved a series of twenty-four vertical plano-cylindrical prisms, the curvature of each being such as to condense the light falling upon it from 15° of azimuth to 5°, so as to produce a flashing light, the intensity of the flash seen from any one place, being three times what the fixed light would give if the revolving cylinder of prisms were removed. The vertical prisms composing this revolving cylinder were not, however, of sufficient height to cover up the whole of the fixed lenticular apparatus, they extended only from the level of the apex of the bee-hive to that of the middle refracting belt, so that while the central lenses and upper prisms supplied the light which was condensed by the revolving prisms to produce the flashes, the whole of the lower prisms of the fixed apparatus were employed to maintain the fixed light; and as the lower prisms collected about one-fourth of the light emanating from the electric arc, and as the vertical prisms by condensation produced an intensity of flash of about three times the remaining three-fourths of the light from the carbon points, it follows that the intensity of the flash would bear to that of the fixed light a proportion of about 9 to 1, but the proportion is by absorption and other causes reduced to that of 8 to 1; that is to say, the distinctive character of the light transmitted by the apparatus would be that of a fixed white light flashing, at equal intervals of time, with a light eight times as strong.

* The first lighthouse on the French coast to which the electric light was adopted was that of La Héve, at the mouth of the Seine. Here, so far back as 1863, one of the signals was illuminated by electricity, and a year and a half later the second signal was similarly altered. In 1875 the Cape Grisnez light, near Calais, was lighted in this manner, and more recently most successful installations have been made at the Palmyre Beacon, and that of Planier, near Marseilles. In the La Héve lighthouse the Alliance machine is used with a Serrin lamp. The lantern contains two stories, each with its electric lamp. There is thus one light vertically above the other, so that in case of a breakdown a complete illuminating apparatus is ready to be thrown into action. In each story there is also a spare lamp, which can be made instantly to replace the one in use. Ample provision is thus made against accident. The most interesting feature, which in our last article we promised to describe, is the means for coupling up one or other, or, in case of fog, both the Dynamo machines, which are always ready for use. This will be readily understood from the small diagram of the commutator plate which we append:—*P*, *S*, and *S'* are copper rods, connected, *P* to the positive poles of both the machines, *S* to the negative pole of machine *A*, *S'* to the negative pole of machine *B*. *P* is prolonged by the cable *p*, *p*, to connection with one carbon of the lamp. *S*, *S'* are connected with the metal plates N, N'; *n*, *n'* are cables running from the plates *N*, *N'* in the same sheath as *p*, *p* to connection with the other carbon of the lamp. N, N' and *N*, *N'* may be variously connected by the movable contact pieces in the centre of the plate. In the position shown the current proceeding to the lamp by *p* returns by *n*, N, *N*, and *S* to machine *A*. If the



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* For the principal details as to French Lighthouses we are indebted to our contemporary, "La Lumiere Electrique."

movable arm be moved from N to N', the current returns by n', N', N', and S' to machine B. If A and B are to be worked together, the central handle is turned until the plates C C' are vertical, the one connecting N, N, and the other connecting N' N'. The current then returns by both routes to both the Dynamo machines A and B. The more modern lighthouses are worked on principles essentially identical with this, though in some instances much more complicated. In the Planier and Palmyre lighthouses the Demeritens magneto electric generators were adopted after exhaustive trials.

The success of these installations has led to the universal adoption of electricity for illuminating purposes in all French lighthouses. A scheme has been prepared, and will be by degrees adopted whereby the whole of the French coast line will be studded with beacons, the effective ranges of which mutually intersect, so that the mariner need never in ordinary weather be out of sight of the warning rays. With the present French system this is the case during only half the year, but the greater penetration of the electric beam will now ensure it during eleven-twelfths of the year; that is, on an average of years, on only thirty days of each year will fog or thick weather be powerful enough to break the chain of light. The ranges for the new beacons on the channel coast, there being 19, will be 23 to 24 miles for ten-twelfths of the year; of those, 13 in number, on the Atlantic Coast 25 to 30½ miles during eleven-twelfths of the year; and of the 11 on the Mediterranean and Corsican Seaboard, 31·8 miles for fourteen-fifteenths of the year. Of course, the beacons are distinguishable from each other by variations in the signal flashes. The estimated cost of transformation is £5,000 for each of 42 lighthouses, or £210,000 in all, to which must be added £70,000 for special cost in several of the installations, and £40,000 for 20 steam sirens, these last being an improvement quite distinct from the adoption of the electric light.

The cost of maintenance is of course greater than for gas absolutely, but very much less than any other mode of illumination, taken light for light. The following table, condensed from one given by Sir James Douglass, is conclusive on this point:—

TABLE SHOWING THE COMPARATIVE COST OF A SINGLE LIGHT, AND THE INTENSITY OF THE LUMINARY PRODUCED AT THE FOCUS OF THE OPTICAL APPARATUS.

	Colza Oil.	Mineral Oil.	Gas, Wigham's System.		Electricity.	
	New Trinity House System.	Trinity House System.	Six Wick Oil Lamp Intensity.	Galley Head Intensity.	One Lizard Intensity.	Two Lizard Intensity.
First Cost.	£	£	£	£	£	£
Land, Buildings and Lantern	5,500	5,500	6,700	6,800	9,500	9,800
Machinery and Plant	200	200	660	1,300	2,300	3,850
Dioptric Apparatus	1,700	1,700	1,700	2,500	1,700	1,700
	7,400	7,400	9,060	10,600	13,500	15,350
Annual Maintenance (including interest on first cost at 3½ per cent.)	2 men. £794	2 men. £693	3 men. £812	3 men. £1,103	5 men. £1,524	5 men. £1,692
Intensity of luminary at focus, mean for 365 nights	candles. 404	candles. 404	candles. 404	candles. 1,866	candles. 4,375	candles. 9,596
Total light per annum in candles	1,782,504	1,782,504	1,782,504	8,234,716	19,305,040	42,339,000
Cost of light per hour	d. 43·2	d. 37·7	d. 44·2	d. 60.0	d. 82.9	d. 92.0
„ „ „ candle or unit	·107	·093	·109	·032	·019	·009

The extreme brilliancy and whiteness of the electric light is considered to give rise to the principal objection which has been urged against its employment in lighthouses, for it is a curious, and, to the uninitiated, an inexplicable phenomenon, that gas is comparatively far more penetrative of fog than the electric beam. The latter—and to this it owes its whiteness—contains a very large proportion of the more highly refrangible, that is, the violet and blue rays of the spectrum, than does the former, which embraces a preponderating supply of the red and yellow rays forming the lower end of the spectrum. Now, the higher rays are far more readily absorbed by fog or mist than the lower, and thus it happens that, given an electric and gas light of equal intensity, the electric beam in a fog gradually loses its whiteness, assumes the reddish-yellow hue of gas, and is finally obliterated, while the latter remains visible. It also follows that an electric luminary, considerably more powerful than one of gas or oil, becomes in a fog but little, if anything, superior to it. But this disadvantage, though powerfully urged by the gas interest as represented by Mr. Wigham, who has done so much in this way among the Irish lights, is of very little moment for two reasons. Firstly, the electric lights employed are so much more powerful that at their worst they are as good as the old beacons; while, secondly, it seems to be conceded that no lights at all can be considered in any way efficient in thick weather, the whole consensus of scientific and practical opinion being in favour of sound signals, by means of fog horns, steam sirens, or such like. And it is curious to note that while fog absorbs light, it greatly promotes the transmission of sound, and also keeps it more concentrated along the sea surface, so that sound signals are most effective just when they are most wanted—in thick weather. But this is a distinct scientific question, on which we cannot here enter. Suffice it to say, that in all probability, at no very distant date, all our lighthouses will receive the benefit of this modern luminary, and that our authorities will recognize the fact that where the question is one of saving life at sea, expense is no consideration.

Docks and harbours are specially adapted for illumination by arc electric lamps, and much good work has been done in this way at Avonmouth, Liverpool, Belfast, London and elsewhere. It may prove interesting to give a short account of the installation at the Royal Albert Dock, London, from information furnished by the well known house of Messrs. Siemens Brothers & Co., Limited. The illumination was commenced in October, 1880, and at first 27 powerful lights were provided, destined to light up the whole dock, comprising 83 acres of water space, nearly 8 miles of quays, warehouses, graving docks, an entrance dock of 12 acres, locks and jetties. These lights are produced by continuous currents from D_2 dynamos, stationed in four groups, each containing a 20 H.P. nomininal engine and boiler, and a timber framing for supporting the counter shaft and electrical machines. The currents from the various machines pass through a commutator, similar in principle to that described above, so that the attendant may connect either machine to any lamp as desired; the current to each lamp also passes through a detector which gives immediate intimation of the accidental extinction of the lamp. All the lamps are enclosed in strong lanterns surmounted by reflectors to throw down the rays, while those nearest the entrance lock have also screens to prevent the horizontal beams passing over the river and disturbing the navigation. The lanterns hang from latticed iron posts (similar to those seen last winter in the City of London), 80 feet high, and the area illuminated by one lamp approximates to 9 acres. The distribution of the lamps has been affected so that ships can be docked and undocked as easily in the night time as by daylight, as was the case with the first ship entering the dock, the Orient S.S. "*Garonne*," on the 27th September, 1880. Last year, 1881, the internal lighting of the sheds was taken in hand, those on the north side of the dock being supplied with lights of 300 candle power maintained by Siemen's alternate current machines placed in two of the existing stations. To the roof of each shed twelve suspenders are attached, six in the interior, three under the eaves on the quay side, and three under the eaves on the railway side, and when a light is required in any part of the shed, lamps are placed upon the suspenders ready for use. The suspenders on the quay side are so arranged that leading wires can be readily attached to them for using portable lamps on board any ship which may be loading or unloading alongside. To convey the electricity to the suspenders, leading wires are laid the whole length of the sheds, a commutator being placed at each shed to enable the attendant to direct the current into the shed or allow it to pass on as required. The electrical power supplied is sufficient to support at one time 80 of these shed lights.

Our readers will readily understand that there have been many applications of the arc light to marine purposes, and there have been a considerable number of searchers, course indicators, &c., designed and employed. They depend on one principle—an arc lamp placed in a parabolic reflector or in a holophote, and so mounted as to be turned in any direction. They have proved extremely useful in naval operations, and their applications are capable of great extension. We may mention as a speciality that M. Mercadier has devised an apparatus for flashing the electric light, so as to render it useful for lighthouse and other signalling. Here the positive carbon is placed vertically above the negative carbon, which is horizontal. The upper carbon is raised from the lower, and the arc thus formed, by a revolving cam, by which it is sustained at the proper height during the arranged period of the signal. Thereon it is allowed to drop, and the light disappears. At the same time the lower carbon is, by a rack and pinion movement, pushed slightly forward, so as to present a fresh surface to the vertical point.' The cam can, of course, be actuated either by hand or clockwork.

In our next number we shall treat of the Incandescent light as applied to the interior illuminations of vessels, and hope to illustrate our article with plans of the decks of one of H.M. troopships, showing the arrangement adopted both for generating and using the electric luminary.

(*To be continued.*)

ON MODERN MERCHANT STEAMERS.

(*Continued from page* 227.)

HEAVIER guns than the 64-pounder were placed on the steamers bought by the Russians in 1878; and an Irish cattle boat, in the hands of the Chilians, was armed with an 8 in. 11-ton gun, and was employed in the bombardment of the Peruvian ports.

In the next place, there is the question of water-tight subdivision.

It was soon found out on the introduction of iron shipbuilding, that a hole can be much more easily made in the bottom of an iron ship than of a wood one; and, as there is very rarely sufficient pump power[*] to keep the leakage under, it follows that, if the bottom is exposed to even feeble local blows, an iron ship is much more easily sunk than a wood one.

In war steamers, therefore, the practice of dividing them into a number of water-tight compartments by iron transverse bulkheads was early resorted to, and by having, in addition, double bottoms, water-tight flats, &c., these compartments have been increased in number, till, in some of our recent ships, there are more than one hundred. Many of these might be filled, and the ship would still float.

But in merchant steamers there has been an extraordinary amount of apathy in the matter. Vessels collided, one or both received some slight damage, foundered in an hour or two, perhaps in much less time, and the result seems to have been regarded as inevitable. And I believe that most people still think so. Every few months a bad case of collision occurs, perhaps with great loss of life, and the newspapers almost invariably remark that there is a fresh proof that water-tight bulkheads are of no use in an emergency. It generally happens that the vessel in question sinks for want of them. Or, if they vary their comment, they say that there ought to have been more boats, or perhaps another pump. I am of opinion that if one-half of the ingenuity and perseverance displayed in devising means of preserving life in case of a ship foundering were devoted to keeping the ship herself afloat, we should attain far better results.

Now, I think it will not appear to you to be asking for an unreasonable amount of subdivision to say that a steamer ought, under ordinary circumstances of weather, lading, &c., to be free from the danger of immediately foundering after collision with another vessel. You cannot, of course, say that safety in collision shall be absolutely guaranteed. A bulkhead may itself be damaged, the ship may be already very deeply laden, or with her altered trim she may be unseaworthy, and succumb to stress of weather; but these are additional and rather remote risks, and ought not to prevent us from saving the ship when none of these further danger, occur. It surely may be granted that a ship ought not to be allowed to go down in a few minutes, when two or three bulkheads would prevent her sinking at all.

So far was this from being the case that there were a few years ago only thirty or forty large steamers in the country which could, even with great leniency of judgment, be said to be so built. Lloyd's Rules insisted on a bulkhead at each end of the ship, and one at each end of the machinery space.[†] And if you build a ship with four bulkheads only, this arrangement is probably as good a one as could be made; but in case of collision between two such vessels, only one of these bulkheads was generally of any use. The ship struck was almost sure to founder; but the striking ship was saved by the collision bulkhead; so that this arrangement might almost be said to offer a premium on running down a vessel which got in unsafe proximity to your own.

In examining the loss of life and property at sea, the small amount of life (compared with property), lost by collisions is mainly due, I believe, to the collision bulkhead saving the striking ship. The vessel struck founders almost at once; but her crew either jump on board the other steamer at the instant of collision, or are picked up shortly afterwards.

Now while this arrangement saved one vessel, two other bulkheads would save the other. Take a steamer of the most common type, a medium-sized cargo steamer. She is compelled to have the collision bulkhead. She must also have two more, which bound the engine-room, though these are sometimes not water-tight. It is then only necessary to make them so, and put in two other bulkheads, and you will insure, in ordinary cases, the safety of the ship.

Something of this kind was frequently attempted in merchant steamers, especially in long passenger ships, but often in a very remarkable manner. The bulkheads were usually so arranged as to give the minimum amount of safety on the given weight of iron. In many ships the great care exercised in making water-tight doors in the 'tween decks was thrown away by cutting large open doorways in the hold. Bulkheads, with elaborate sliding doors in the hold, had their tops below the water level. Some vessels had as many as ten or twelve bulkheads, of which but one was of the slightest use in collision.

Good subdivision has been said to be impracticable, on account of the expense and the inconvenience of arbitrarily dividing the holds.

The best reply is that it is now very generally done. Even in 1875 there were large firms all of whose steamers were so built, and now there are no first-class mail steamers building which are not so constructed. All the passenger steamers built during the last three or four years for the Allan, Anchor, British India, Clan, Colonial Mail, Cunard, Guion, Inman, Monarch, Orient, Peninsular and Oriental, and Union Lines comply with the condition above referred to.

Many other companies own Atlantic cattle and cargo steamers colliers, and passenger paddle river boats, which are similarly built These facts will probably be taken as conclusive of the question of the practicability of bulkheads in steamers.

The expense is small. One firm estimated it as £300 each for altering a fleet of mail steamers. But the cost of introducing them while building, or in many cases of merely arranging them so that they shall not be useless, is much less. And I imagine that very little extra cost is involved in inserting in the contract, as is now generally done in these cases, that the ship is to be built with bulkheads to meet this condition. The loss of money due to one large vessel sinking would pay for this extra work in three or four times as many ships as are yearly registered.

A very long saloon is the greatest difficulty met with, but long saloons with cabins at the sides are otherwise objectionable, and are being discontinued.

In cargo steamers it is evident, on looking at the diagram, there is no difficulty at all. You have the same hatches, the same winches, and the same stowage with bulkheads or without them, and the bulkheads confine local leakage and consequent damage to cargo.

There is one other objection I have heard. It has been said by eminent builders and others in this Institution that these bulkheads cannot be relied on. A few test cases may be interesting.

(*To be Continued.*)

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[*] In some of the latest mail steamers very powerful pumps have been fitted; but the above statement is still substantially true.

[†] There has been recently added to Lloyd's Rules a recommendation that in steamers 280 ft. long and above, an additional bulkhead be fitted in the main hold extending to the main deck. It is to be regretted that Lloyd's have not gone further in this direction.

Review.

A Manual of Naval Architecture. By W. H. White, Chief Constructor Royal Navy, &c., London. John Murray, Albermarle Street.

THIS exhaustive treatise consisting of over 670 pages of readable and instructive matter, is undoubtedly the very best of its kind which has ever been offered to the thousands upon thousands of our countrymen whose sole energies are devoted to the marine profession. Unlike any former works of the kind which we are acquainted with, this book may be read with benefit and studied with profit by the general interested public, the seafarer, the marine engineer, and the naval architect and constructor.

Earlier works of this kind seem to have been compiled by the authors with the view of showing to the world at large what clever mathematicians the writers were, and the immense surface of paper which they could cover by using large type and spreading the same as much as possible, thus producing volumes of such immense bulk and weight, in some instances, that great muscular development was quite as necessary in handling them as brains to understand their contents. In mentioning the brains required to understand contents, we must explain that it seems to have been a study of earlier writers in this profession to carefully avoid giving facts and figures of an elementary and explanatory nature unless too many outsiders might follow their method of reasoning far enough to discover many fallacies which were then in existence. The usual method of procedure in such cases was that a few general opening remarks were made on each specific subject, after which the authors launched into a labyrinth of figures and unexplained formula perfectly bewildering. Books of this kind have been purchased time after time by students and shipbuilders only to be thrown aside as useless as far as the information they required was concerned, such valueless works may be now seen on sale at nearly waste paper price.

A growing desire increasing with rapid strides has been spreading in the marine world for a long time, that a work might be met with which would assist all classes of inquirers in a simple and and practical form. This desire had been freely communicated to Mr. White by the students of the Royal Naval School, at Greenwich, and many others before he essayed the difficult task of giving them the useful matters now before us. The author of the present work was most specially qualified for the great task of modelling a hand book explaining the many intricacies of the science of naval architecture, and defining rules and methods for carrying out the same, which will be understood when we explain that, independent of his arduous duties as a Chief Constructor to the Royal Navy, Mr. White was for many years the Instructor in Naval Architecture to the Royal Naval School at Greenwich. As far as practicable the course of lectures, delivered throughout a number of years at the Naval School, are embodied in this work.

The first chapter deals with the displacement and buoyancy of ships, and gives rules for estimating the same as also the construction and uses of curves of displacement, curves of tons per inch immersion, and the requisite reserve of buoyancy for various types of ships. The causes of the foundering of ships, with improved principles of watertight subdivision by transverse and longitudinal bulkheads, and by decks or platforms, is well explained, and the chapter concludes with a most instructive account of the rules for freeboard, and the recent legislation respecting load-draughts.

Chapter 2 deals with a subject which has for generations excited endless controversy, viz., the question or problem of tonnage, measurement, and rules. This commences with a description of early systems of tonnage measurement, continuing with builders' old measurement (B. O. M.), displacement tonnage, register tonnage, Suez Canal, and Danube Rules, &c., concluding with remarks on freights, tonnage and yacht measurements for time allowances in racing. The latter describes the Thames measurement rules, the Yacht Racing Association's rules, and the Corinthian and New Thames Yacht Clubs' rules, showing the advantages and disadvantages attached to the application of each individual rule.

Chapter 3 deals with the statical stability of ships. The definitions of *stable* and *unstable equilibrium*, as also *neutral* or *indifferent equilibrium* and the *statical stability* of ships, are simply and effectively dealt with. We are then led on to consider the causes and effects of transverse and longitudinal inclinations, with the usual methods of obtaining the positions of the metacentres and arriving at the moment of statical stability at different angles of heel.

The terms, a *stiff* ship, a *crank* ship, and a *steady* ship, are clearly explained, so that one may judge which of the three would be most seaworthy in a seaway. Then the changes produced in the stiffness of a vessel by the relative height of the metacentre above the centre of gravity, and a series of tables giving results from ships of various sizes shows the best medium height suited to different classes of vessels. Then again the tabular statement of the results of inclining experiments made on various types of merchant steamers, sailing ships, and celebrated yachts, are very complete and valuable.

The mode of constructing metacentric diagrams, and the uses of these diagrams, and the construction and uses of curves of stability, are also discussed, and explained in detail, with numerous diagrams from all classes of men-of-war and merchant ships. The effect upon stability of vertical movement of weights, and the heeling produced by transverse shift of weights, the effect upon stability of water in hold, and of addition or removals of weights, estimates for change of trim, and other cognate and essential points, are skilfully and carefully treated, the whole chapter forming a most valuable and useful fund of practical and scientific knowledge.

The three chapters above referred to are most valuable additions to the practical rules and requirements of floating bodies and vessels of every description, and forms a complete section of the greatest value independent of the other portions of this work.

Chapters 4, 5, 6, and 7, may be classed as another complete section. These deal respectively with the oscillations of ships in still water; the theories of deep-sea waves; the oscillations of ships among waves; and the methods of observing the rolling and pitching motions of ships. In Chapter 4 the author deals with the angular velocity, accelerating force, and moment of inertia, the motion of metacentre during rolling giving formulæ for unresisting rolling, changes produced by distribution of weights, modes of estimating dynamical stability, the effect of fluid resistance on rolling, and concludes with many other most useful and complete details. Chapter 5 is an exhaustive treatise of the deep-sea wave theory, and the utilization of wave power. The construction of waves and the intensity of fluid pressure incidental to wave motion, the force and dimension of waves, &c., other essential points are most fully and usefully explained, and will be found invaluable to any interested student or observer, and to every shipbuilder and naval architect.

Chapter 6 carries the reader to the application of the combined theories expounded in the two foregoing chapters, and deals with the oscillation of ships among waves. The opening portion gives the early theories of rolling and the principal features of the modern theory, the fundamental assumptions of unresisted rolling and practical deductions from investigation of unresisted rolling, compared with observances of the rolling of ships at sea. The valuable researches and records of the late Mr. W. Froude and M. Bertin are here referred to. This chapter terminates with a full description of the steadying effect of sails of longitudinal oscillations, "pitching," and "scending," and other information which cannot be noticed for want of space. Chapter 7 shows the necessity for observations of the rolling and pitching motions of ships, giving illustrations and descriptions of the different apparatus in use for obtaining such records correctly.

The seven chapters we have referred to form about one half of the whole work. It will be necessary to defer till our next issue a detailed notice of the remainder, as to give any idea of the great value of this portion of the treatise a large quantity of space will be necessary to do a limited amount of justice to the highly important subjects contained therein.

(*To be continued.*)

THE VENTILATION OF SHIPS.—No. 3.

BY far the greatest loss of life and property and injurious consequences generally which have resulted from a defective system of ventilation of ships, is from the spontaneous combustion and the explosion of coal cargoes, and from the accidental firing of inflammable vapours from benzoline, xerotine siccative, and other chemicals.

In the year 1875, at the suggestion of the London Salvage Association, and with the hearty concurrence of the Committee of Lloyd's, a Royal Commission was appointed to make enquiry concerning the causes of the spontaneous combustion of coal in ships, and the remedies which might possibly be adopted for preventing and guarding against them. In this investigation a very important mass of testimony was taken from several witnesses of scientific skill and practical experience respecting the subject of the enquiry, and in addition to shipowners, shipmasters, coal merchants, coal shippers, colliery owners, and mining engineers, the following officials were examined, viz.; the Manager of the London Salvage Association, the Chief Inspector of Machinery, and the Chief Engineer and the Inspector of Coal

Shipments to the Admiralty, the Assistant to the Secretary of Underwriters' Association of Liverpool.

The report of the Royal Commissioners on this evidence, to which is appended a scientific statement by Dr. Percy and Professor Abel, two members of the Commission, which describes the chemical conditions which tend to originate and develop spontaneous combustion, and those which produce explosion, is a very appreciable document. Comparatively little, however in it relates to explosion from coals in ships, whilst explosions therein from inflammable chemicals is not discussed either in the evidence or in the report. A very important memorandum has, however, since been published by Mr. Thomas Gray, Assistant Secretary Marine Department of the Board of Trade, relating both to spontaneous combustion and explosions from coals in ships, and an excellent little book has just appeared, from the pen of Mr. Thomas Rowan, C.E., which not only treats upon these accidents, but also respecting explosions in ships from the inflammable vapours of chemicals. From both these last mentioned treatises we are indebted for a substantial portion of the observations in this article.

According to the report of the Royal Commission, it appears from a return furnished to them by the Committee of Lloyd's, that the proportion of casualties, traceable to spontaneous combustion, increases *pari passu* with the tonnage of the cargoes. This becomes still more apparent when the European trade is deducted, the return then shows that there were in 1874, 2,109 shipments with cargoes under 500 tons, in which 5 casualties occurred, or under ¼ per cent.; 1,501 shipments, with cargoes between 500 and 1,000 tons, in which 17 casualties occurred, or over 1 per cent.; 490 shipments, with cargoes between 1,000 and 1,500 tons in which 17 casualties occurred, or 3½ per cent.; 308 shipments, with cargoes between 1,500 and 2,000 tons, in which 14 casualties occurred, or over 4½ per cent.; and 77 shipments with cargoes over 2,000 tons, in which 7 casualties occurred, or over 4½ per cent.

The casualties in vessels bound to San Francisco were the most remarkable. Deducting vessels under 500 tons (in which no cases of spontaneous combustion were recorded), the return shows 9 casualties out of 54 shipments. These also increase in proportion to the tonnage of the cargoes, till we arrive at the alarming fact that out of the 5 ships with cargoes, over 2,000 tons sent to San Francisco in 1874, 2 suffered. Thus it becomes evident that spontaneous combustion has occurred principally in vessels carrying over 500 ton cargoes, bound to the West Coast of South America, San Francisco, or to Asiatic ports beyond the Mediterranean and Black Seas. Of such shipments over 4 per cent. suffered in 1874; and though they only amounted to 1,181 out of the 31,116 shipments for the year, yet among them occurred 51 out of the 70 casualties. Some very important tables are given in Mr. Gray's memorandum, from which we notify the four following, namely: Table showing the total number of *known* cases of *spontaneous combustion* occurring in British owned vessels :—

Year.	Total Loss.	Partial Loss.	Total.
1871	2	3	5
1872	5	4	9
1873	12	3	15
1874	16	13	29
1875	6	12	18
1876	11	12	23
1877	7	10	17
1878	4	9	13
1879	—	9	9
1880	5	9	14

Cases of explosion reported in British owned vessels during ten years :

Year.	In Sailing Vessels.	In Steam Vessels.	Total.
1871	3	2	5
1872	1	2	3
1873	2	7	9
1874	2	2	4
1875	—	4	4
1876	4	6	10
1877	3	8	11
1878	3	11	14
1879	3	4	7
1880	3	7	10

Number of coal laden vessels which were reported *missing* during the eleven years, ending December 31st, 1880 :—

Year.	Steam.			Sailing.			Total.		
	No. of Vessels.	Tonnage.	No. of Lives Lost.	No. of Vessels.	Tonnage.	No. of Lives Lost.	No. of Vessels.	Tonnage.	No. of Lives Lost.
1870	1	261	18	17	6,261	192	18	6,522	210
1871	—	—	—	15	7,994	219	15	7,994	219
1872	1	1,050	26	33	13,855	361	34	14,905	387
1873	4	2,862	93	32	10,910	323	36	13,772	416
1874	5	2,827	103	46	18,295	536	51	21,122	639
1875	3	1,337	52	26	5,158	186	29	6,495	238
1876	3	2,553	70	27	10,198	286	30	12,751	356
1877	4	2,357	68	24	6,913	219	28	9,270	287
1878	3	1,420	49	14	8,395	186	17	9,815	235
1879	5	5,286	118	25	7,489	214	30	12,775	332
1880	4	3,464	86	26	8,201	225	30	11,663	311
	33	23,415	683	285	103669	2947	318	127084	3,630

Total showing the number of coal laden vessels which were reported as missing during ten years, ending 31st December, 1880, distinguishing the vessels which sailed on short voyages from those which sailed on long voyages, and also distinguishing steam ships from sailing vessels :—

Year.	Sailing.			Steam.			Total.		
	Long Voyage.	Short Voyage	Total.	Long Voyage.	Short Voyage	Total.	Long Voyage.	Short Voyage	Grand Total.
1871	7	8	15	—	—	—	7	8	15
1872	11	22	33	—	1	1	11	23	34
1873	7	25	32	2	2	4	9	27	36
1874	17	29	46	1	4	5	18	33	51
1875	3	23	26	—	3	3	3	26	29
1876	8	19	27	1	2	3	9	21	30
1877	6	18	24	1	3	4	7	21	28
1878	5	9	14	—	3	3	5	12	17
1879	5	20	25	1	4	5	6	24	30
1880	7	19	26	1	3	4	8	22	30
	76	192	268	7	25	32	83	217	300

It appears that up to the present time the risks of carrying coal cargoes have not been reduced in the opinion of underwriters, and the premiums for carrying these cargoes, which was nearly prohibitive in 1875 for long voyages, have again increased. Indeed we are told that the rates from the port of Liverpool have increased 5s. to 10s. per cent. since December, 1881, whilst at Hull, underwriters decline to quote for long voyages unless for sporting risks.

Several recent investigations have been made respecting the cause of spontaneous combustion of coal in ships, some of which differ. The definition, however, given by Mr. Rowan, appears to be the most concise and appreciable. He tells us "that results of all sound research into those chemical changes which cause (so-called) spontaneous combustion or ignition of coal, is to demonstrate that it can arise for two sources—1st, the oxidation of some of the sulphur compounds existing in coal—2nd, the absorption and condensation of atmospheric oxygen by the carbon pores of coal, otherwise carbonaceous oxidation. Under certain conditions, which we will examine, both of these actions take place accompanied with the evolution of heat, and if carried on with sufficient energy, such elevations of temperature can be induced as to result in the ignition or combustion of the coal. Sulphur in coal is found in two forms of combination, as a sulphide, as in pyrites, or as a sulphate, as in sulphate of lime. In the latter form it is stable, and being already completely oxidized it cannot develop heat. The chief, if not the only form of sulphur in coal which gives rise to spontaneous combustion, is its combination with iron, known as iron pyrites, or "brasses." This combination of sulphur is more or less present in every variety of coal. Sometimes it occurs in massive forms or laminæ, sometimes in fine filaments, and sometimes in minute crystals. Pyrites is known to exist in the mineral kingdom in the cubical form, having a bright yellow colour, or in the prismatic form, exhibiting a white metallic appearance. With the varying physical conditions under which pyrites exist in coal, so does its stability alter, some forms of pyrites readily commencing oxidation on free exposure to the atmosphere, while others require some exciting cause, such as heat, before oxidation begins. In all cases *moisture* promotes this oxidation, if, indeed, its presence is not absolutely essential to its taking place at all. The oxidation of pyrites is always slow, and its rate of progression is also commensurately slow. This action has therefore to be conducted on sufficient mass before the accumulated heat can so accelerate the oxidation as to arrive at temperatures requisite for ignition. We have already seen that coal has the power more or less of absorbing atmospheric oxygen. With some varieties of coal the action can also result in ignition. This occurs with charcoal, if stacked soon after its preparation, the highly porous structure of the charcoal offering essentially favourable conditions for rapid absorption. Coal presents great variety in structure and texture, some being open and porous, others compact. Some varieties are soft and friable, crumbling with friction or pressure. Others again can resist considerable pressure without disintegration. In my opinion, however, the mechanical conditions, as presented in the average size of the lumps of which coal cargoes are made up, and the proportion their quantity bears to the amount of small coal mixed with them, are not such as tend unaided to promote carbonaceous oxidation with sufficient rapidity to cause ignition, and therefore in the majority of cases the spontaneous combustion of coal on board ship has in the first instance been due to other causes. The experiments of Richters show the coal under certain conditions can spontaneously ignite from solely carbonaceous oxidation." According to Dr. Percy, "it was reserved for Richters to substitute fact for opinion, and to demonstrate by experiments, which in my judgment are conclusive, that generally the spontaneous ignition of coal is due to the heat developed by atmospheric oxidation of the organic substance of coal, and not to that resulting from the oxidation of iron pyrites. He has shown that coal most liable to spontaneous ignition is not that which contains most iron pyrites. . . . Atmospheric oxidation of iron pyrites is always a comparatively slow process, and consequently there must be much loss of heat. It is not, however, asserted that iron pyrites may not, when present in coal in considerable quantity, develop sufficient heat during its oxidation by atmospheric air to set the coal on fire."

(*To be continued.*)

PATENT STEAM CHECK OR ISOLATING VALVE.

THIS invention, which is patented by Messrs. J. Hopkinson & Co., of Britannia Works, Huddersfield, is applied for the purpose of isolating and protecting connected boilers. Engineers, experienced in the use of steam boilers will be too well aware that in a connected group or range, conditions arise which can never exist in a disconnected boiler. The appliances attached to a single boiler can only be affected by the action of the steam and water contained therein; but where a group of boilers are connected in their steam-ways, any single boiler of this group may be placed in such a condition that its appliances may, for the time being, have to do duty for all the boilers so connected. The excessive duty thrust suddenly on such appliances would very probably lead to serious results.

When boilers are connected in their steam-ways without a self-acting check valve, they may be said to form one huge steam boiler or machine, consisting of many parts. Whatever occurs to any one boiler, or to any part thereof, the whole volume, or quantity of steam contained in the other boilers is acting and pressing for the time being upon the one in which accident may have occurred. Some of the causes of accidents arise from defective stop-valves, faulty blow-off taps, breakages of blow-off pipes, steam-pipes, water-gauge glasses, or leakages.

It will, therefore, be seen that where there is a number of boilers connected, there is collected an agency of immense destruction, which increases as the numbers are grouped together.

The accompanying plate is a sectional illustration of the patent steam check valve. A is a brass valve, closing upwards. B is an iron float or plunger, submerged in mercury, contained in the vessel C. The top side of the valve A is the inlet side to which the steam comes on leaving the boiler. The under side of the valve A is in connection with the main steam pipe, which conveys the steam from all the boilers in connection with the engine. The iron float B has a predetermined amount of buoyancy given to it, so that it will rise and close the valve against its seat whenever it may be in equilibrio of pressure. For example, suppose the valve to be 6 in. diameter = 28·274 in. area, and that the plunger B has a buoyancy of 7 lbs. given to it, thus ¼ lb. per inch pressure on the upper side of the valve, or ¼ lb. per square inch in excess of the pressure on the under side of the valve will suffice to press it down and maintain it open; but whenever there may be an equal pressure on the upper and under side of the valve, it will at once close with absolute certainty.

The tendency of the valve to knock against its seat is entirely obviated. If the valve was loose on its spindle, in the manner of the water feed check valve, it would strike against its seat violently and continuously, by the intermittent flow of the steam. This steam check valve cannot do so, for by reason of its peculiar and novel arrangement it can only close gently, and without the least impact; and in the short interval which elapses between the regular intermittent flow of the steam from the boiler to the engine, there is not sufficient time for the valve to move sensibly towards its seat; and only when the steam has ceased to flow will the valve really close. This desirable action of the valve is accomplished in a manner both simple and efficient.

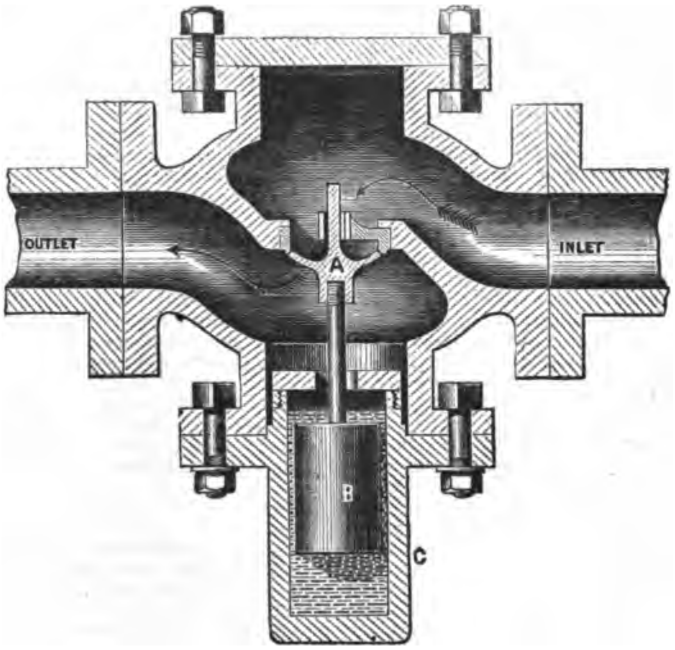
Whilst the plunger B is free to rise and fall in the mercury contained in vessel C, practically without friction, yet it can only move at a comparatively slow rate, because the mercury requires time to pass through the thin annular space between the plunger and the vessel. This effectually prevents all objectionable oscillation of the valve by the varying flow of steam.

To enumerate the many and varied circumstances in which the steam check or isolating valve would prove advantageous would form a somewhat lengthy category, but a few of the more obvious and important circumstances and objects which it is the function of this valve to meet may here be given. and many others will from time to time occur to the observant engineer.

It will completely isolate any one boiler of a series, and if it should be empty will form a self-acting safety-valve without requiring the vigilant watchfulness of any one. It will be a protection against a leaky stop-valve, or in the case of anyone opening the stop-valve, when the boiler is off, and when some person, perhaps, is inside. It will obviate the risk to which boiler inspectors have been subjected and entirely relieve them from the constant dread which has haunted them in the execution of their duties, and will be a protection against loss of steam from all the boilers in the case of any one of a set becoming leaky, or any of the pipes breaking (other than the main pipe), as it renders the boilers separate and distinct from the others under such condition, whilst, for all normal and required purposes, it is no inconvenience, as it permits the steam to flow in the ordinary and appropriate channels as if no such valve had been applied.

It will also, under many circumstances, prevent sudden and excessive priming of the boilers, because, by the nature of its construction, the valve can only open gently and slowly; and it will remain open to such extent only as may be necessary for the normal quantity of steam to pass through.

We cannot but state that this check valve is a perfect remedy for a defect that has long been seen and felt, which although anxiously sought for, has never before been so successfully applied.



PATENT STEAM CHECK OR ISOLATING VALVE.

This firm supplied the boiler used for driving the machinery at the North-East Coast Exhibition at Tynemouth. The boiler was constructed on the Fox and Hopkinson principle, with corrugated flues, and conical pipes for circulating the water.

Messrs. Hopkinson & Co. also exhibited, at the above place, a parallel slide-tap of new and special construction. This valve has double slide discs, with springs between them, which, during opening or closing does not allow them to lift from the faces. On this account no dirt or grit can adhere thereto, thus preventing the valves from being cut or otherwise destroyed, and stopping leakage.

The spring placed at the back of the two discs provides for all expansion and contraction caused by the varying temperature of steam or water. This class of make was applied to the boiler used at the Naval and Marine Exhibition, Tynemouth, as was also the patent steam check. At this exhibition there was a most wonderful effect produced, which cannot be otherwise than interesting to engineers and general users of steam boilers. The Fox & Hopkinson's corrugated flued boiler was let off for inspection in the ordinary way, and it was found the scale had fallen from the flues and lay at the bottom in heaps. The power of the corrugated flues to discharge or displace scale has thus been most satisfactorily illustrated, and has been highly approved of by the many scientific men who have had the opportunity of seeing it. There is also another feature in this matter which is interesting. Messrs. Hopkinson have had the inside of boiler with the fallen scale photographed, and as this is an entirely new feature in the art of photography there is some praise due to the artist, Mr. Stabler, of Sunderland, and Mr. Farmer, the electrician of the Marine Incandescent Electric Light, as by the careful manner in which these lights have been placed inside the boiler the mechanical portion is not seen, yet the light is so distributed that the interior portion of the boiler under the flue is distinctly photographed.

New Postal Telegraph Steamer.—In order to supply a long-felt want in connection with the telegraph system, the Postmaster-General has just contracted with Messrs. D. J. Dunlop & Co., Port Glasgow, to build for the service of the Post Office an iron screw-steamer, specially constructed for the laying and repairing of telegraph cables, from designs furnished by Mr. Joseph H. Ritchie, Fenchurch Street, London. The principal particulars of the vessel are:—Length, 240 ft.; breadth, 33 ft.; depth, 20 ft.; to be propelled by a pair of engines having cylinders 30 and 58 inches diameter, with a length of stroke of 48 inches. To meet the requirements of the distinctive work to be performed, the steamer will be fitted with three circular telegraph cable tanks and a double bottom for water ballast, with fittings adjusted to trim the ship as the cable is played out.

ON THE ECONOMY OF COMPOUND ENGINES*

By W. Parker.

DURING the last few years I have watched with great interest the steam pressure in merchant ships increased from 60 lb. per square inch to 70 lb. and then to 80 lb., and from inquiries amongst my friends I have learned that an appreciable gain in economy of fuel resulted therefrom. At present very few engines are being made to work at a lower pressure than 80 lb., while 90 lb. appears to be the more common pressure in use; still I am almost inclined to doubt if sufficient economy of fuel can be realized by going above 80 lb. or 90 lb. per square inch with the two-cylinder type of engine now in use. Having lately been investigating this subject I think that a short description of the results obtained may not be uninteresting to this meeting.

The reason why, in general, higher steam pressures are conducive to economy is that they render possible a greater measure of expansion, as the most part of the work is done without any further expenditure of heat than originally supplied in the steam before expansion, but there are limits beyond which expansion of steam is not beneficial, and it is to these limits that I wish to draw attention.

If we conceive a perfect gas originally at a high pressure and at any temperature to expand during work, the work will be done at the expense of the heat of the gas, and its temperature will fall by an amount proportional to the work done during expansion, unless an equivalent amount of heat be added as expansion takes place. If this heat be added, the relation of the pressure and volume during expansion is such that their product at any time is constant, but if no heat is added during expansion the pressure falls much below that which it would have been according to this law.

In the case of steam we have a much more difficult matter, as any reduction of temperature below that due to the pressure causes immediate condensation. However, when the law by which the pressures and temperatures of steam vary is known, and also the total amount of heat necessary to produce steam of any given pressure, we are able to calculate the variations of pressure and volume of steam, if we know what heat is given to or taken from it, and also what work is done by it during expansion.

For example, if we take a given volume of dry saturated steam at a pressure of 140 lb. per square inch (absolute), and let it expand doing work, we shall require to add heat to it at every step of the expansion in order to prevent liquefaction taking place, and although heat is added its temperature fails.

This is represented on the diagram Fig. 1, by the dotted line, the temperatures at the various pressures and volumes being marked in figures thereon. If now we were to allow the steam to expand without adding heat to it or taking heat from it, but doing work during expansion, we should have partial condensation taking place; the process being represented by the dotted line on the diagram Fig. 1, the horizontal distance between which and the full drawn line at any pressure representing the amount of condensation which has taken place. If now we could by any possibility allow steam to expand thus, say by using a perfectly non-conducting cylinder, we should get the maximum of work possible out of the steam, but as I have stated condensation must then take place. In practice, however, we are compelled to use cylinders of metal, the inner surfaces of which must be polished, and of course polished metal is a very superior conductor of heat; the inner surface of the cylinder must therefore always be tending to become of the same temperature as the steam immediately in contact with it. When it is colder than the steam it rapidly condenses part of it, absorbing its latent heat until its increased temperature is equal to that of the steam, while if the temperature of the steam is less than that of the cylinder, the surplus heat of the cylinder will, by evaporating any condensed moisture on its surface, rapidly lose heat until equilibrium of temperature again results.

This is the process which must take place in a cylinder every stroke if the piston moved sufficiently slow, but even with a fast-moving engine the temperature of the inner surface of the cylinder will always be somewhere between that of the steam at entry and exit. When, therefore, the steam first enters any cylinder, its temperature is reduced by contact with the cylinder, and a certain amount is condensed; the effect of this is to warm the walls of the cylinder and the piston; as expansion takes place the temperature of the steam falls until it becomes lower than that of the cylinder, and then the hotter cylinder re-evaporates part of the condensed steam; when the exhaust opens, a further reduction of pressure takes place as it escapes into either a receiver or a condenser, and thus the re-evaporation becomes complete.

On fresh steam re-entering, as much of this is condensed as is required to raise the temperature of the cylinder to that of the entering steam; the effect of this whole operation is to admit a larger quantity of steam from the boiler than ought to be required to fill the cylinder. It will thus be seen that in an actual engine the expanding steam must be having heat abstracted from it during a part of the forward stroke by the cylinder walls, in addition to that converted into work, whilst an amount of heat is added to it during the latter part of the same stroke, and during the whole of the return stroke in re-evaporating the condensed steam. The portion returned to the steam during the forward stroke helps to do some useful work by increasing the forward pressure, but the portion added to the steam during exhaust (really by increasing the back pressure) not only is directly wasted, but is actually creating resistance. It is therefore evident that the greater the amount of expansion the greater will be the range of temperature, and the greater the range of temperature the greater will also be the amount of liquefaction and re-evaporation taking place, so that a point is reached at which with further expansion the greater variation of temperature causes greater losses of heat than is compensated for by the additional work done. Now, provided we can expand the steam continuously, allowing the pressure to fall only as work is done, it is immaterial whether the expansion is effected in one or in more cylinders.

In the compound engine as in general use, however, this expansion is somewhat interrupted, the steam after it is cut off in the high-pressure cylinder expands until it fills this cylinder, and at the end of the stroke it expands further, without doing work, into the receiver; this represents a loss compared with what would have been realised by continuous expansion, and in addition, the steam having to pass through tortuous passages in obtaining its exit from the high-pressure cylinder into the receiver, and from the receiver into the low-pressure cylinder a loss of direct pressure is experienced, the forward pressure in the low-pressure cylinder when this is fully open to the receiver being generally two or more pounds less than the back pressure in the high. These losses of power are represented graphically by the gap between the high and low pressure diagrams when expanded as shown in Figs. 1, 2, and 3, and the continuous expansion curve.

Although a very considerable loss may thus be shown to take place in the best designed compound engine, yet the fact has been proved beyond question that the compound engine even with this loss is more economical by far than the simple engine, and the reason it is so is because by expanding the steam in two cylinders the range of temperature becomes divided into two, and in neither cylinder does such a great amount of condensation take place. For instance, with steam of 60 lb. per square inch above the atmosphere expanding to say 10 lb. absolute, or 5 lb. below the atmosphere, a single cylinder will be exposed to a range of temperature from 307 to 194 degrees during the forward stroke, and then to 100 degrees during the return stroke, while in the compound engine the ranges will be from 307 to about 215 degrees in the high-pressure cylinder, and from 215 to 100 degrees in the low.

In an ordinary compound engine, as we increase the pressure so also do we at the same time increase the range of temperature, and further, unless the high-pressure cylinder is made unduly large, so that a long range of expansion takes place in it, a large amount of unbalanced expansion takes place from the high-pressure cylinder to the receiver. Thus in Fig. 3 (s.s. *Northern*) we see a great gap between the diagrams and the curve, so that together with increased condensation a limit must be reached in which further expansion in the two-cylinder engine will produce more losses from these causes than the gain from the additional expansion, exactly in the same way as with the simple engine a limit was soon reached beyond which additional expansion was injurious. In other words, if pressures and expansions are carried beyond this limit, we shall have to again compound our compound engines.

What this limit is, must be ascertained by direct experiments, and I am sure that the engineering world are looking forward with intense interest to the results which will be obtained by the s.s. *Aberdeen* on the forthcoming voyage as an experimental fact towards settling this point.

Unfortunately, with marine engines it is almost impossible to determine their absolute efficiency, the only facts as to their performance which can be accurately noted are the indicated horse powers and the consumption of fuel. This gives a measure of the efficiency of the engine and boiler combined, but in order to eliminate the boiler, we would require to know in addition the amount of water evaporated, and also the amount of condensation water, and its rise of temperature (this would enable us to know

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* Read at the Twenty-third Session of the Institution of Naval Architects.

ON THE ECONOMY OF COMPOUND ENGINES.

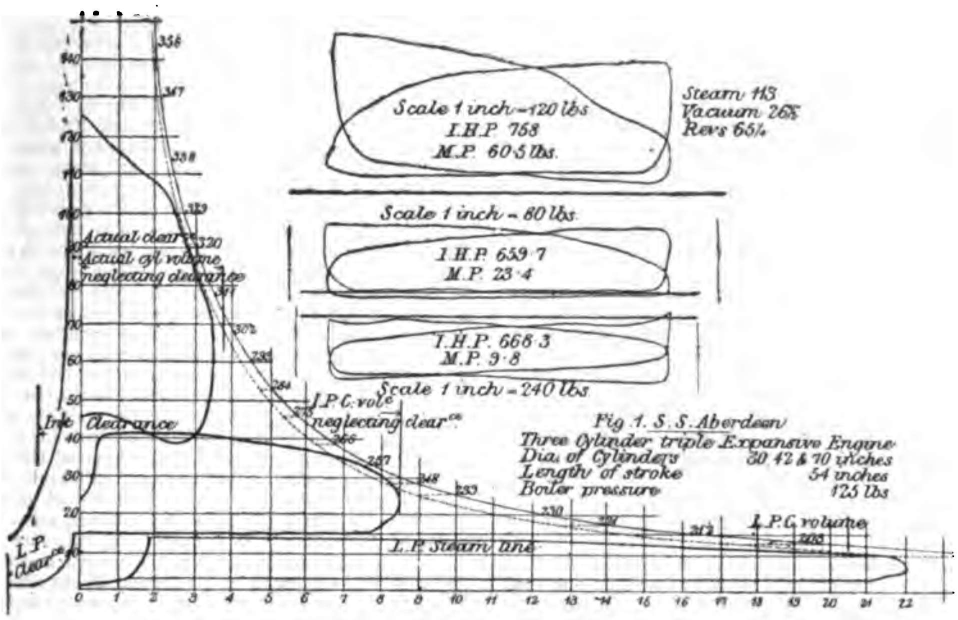
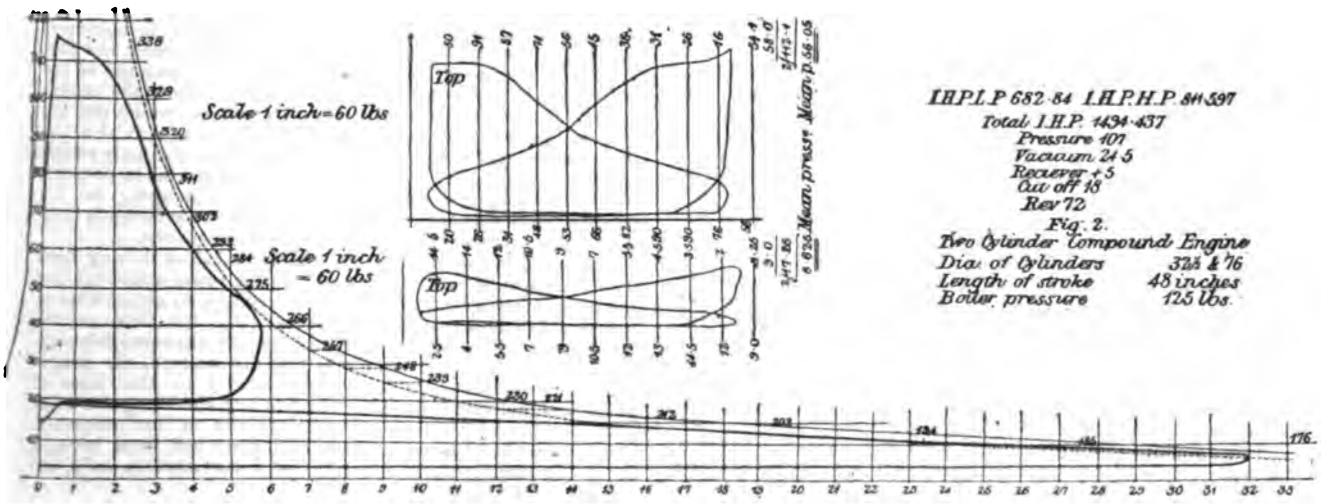


Fig. 1. S. S. Aberdeen.
Three Cylinder triple Expansive Engine
Dia. of Cylinders 30 42 & 70 inches
Length of stroke 54 inches
Boiler pressure 125 lbs



I.H.P. L.P. 682·84 I.H.P. H.P. 811·597
Total I.H.P. 1494·437
Pressure 107
Vacuum 24·5
Reciever + 5
Cut off 18
Rev 72

Fig. 2.
Two Cylinder Compound Engine
Dia. of Cylinders 32½ & 76
Length of stroke 48 inches
Boiler pressure 125 lbs.

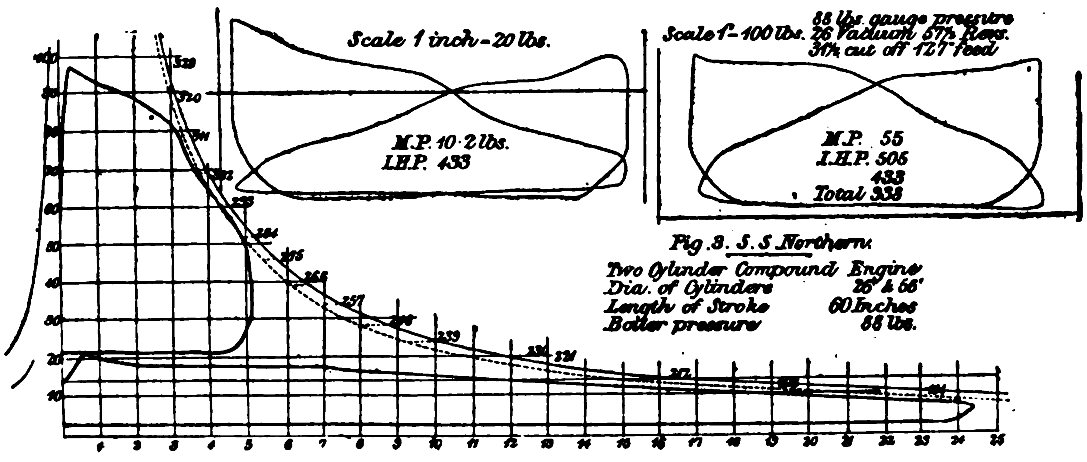


Fig. 3. S. S. Northern.
Two Cylinder Compound Engine
Dia. of Cylinders 26" & 56"
Length of Stroke 60 Inches
Boiler pressure 88 lbs.

how much water was in the steam when it enters the engine, and also at any subsequent part of the stroke), but these quantities are not measurable in engines of large power such as are fitted to the ordinary steamers employed in the mercantile marine.

Although it is impossible from the indicator diagrams to ascertain how much condensation takes place, yet in carefully analysing them, the re-evaporation during the latter part of the stroke can easily be seen, but that which takes place when the cylinder is open to the condenser cannot, of course, be ascertained in this way. If the clearance spaces of each cylinder be accurately measured, and the actual volumes of the steam at each pressure be set off in a diagram, as shown in the figures, it will be found, I believe, in every case that after the cut-off the curve formed will rise higher than the adiabatic curve through the cut-off point, showing that re-evaporation does take place, while in all cases the low-pressure diagram will fall below the adiabatic curve drawn through the fullest point of the high-pressure diagram, further showing that some portion of the steam must pass through this cylinder as water, never showing on the indicator diagram at all, being re-evaporated during the return stroke directly into the condenser.

I have constructed diagrams showing the relative volumes and pressures of steam in the case of s.s. *Aberdeen*, taking indicator diagrams kindly given to me by Mr. Prior, from the performance of that vessel at the power at which she will work at sea, and also from diagrams taken from two two-cylinder compound engines, one of them working at the same boiler pressure, viz., 125 lb. per square inch.

It will be observed that in the latter case a considerable departure is visible in the high-pressure diagram from the adiabatic curve (or curve of perfect engine), while very considerable condensation is shown in the low-pressure cylinder more than that in the high pressure, and considering the rapid rate of evaporation in the high pressure cylinder towards the end of the stroke, I believe that a very considerable amount of the steam must even thus be left condensed.

In the two first diagrams of the s.s. *Aberdeen* very little evaporation is shown, and this is what we should have expected from the small range of temperature in them. Again, in the case of the engines of the s.s. *Northern*, being ordinary compound engines working at a pressure of 88 lb. per square inch, although the compression parts of the diagram clearly show that the high-pressure piston is leaky, yet the pressure in this case towards the end of the stroke rises above the adiabatic curve, while very considerable condensation has taken place in the low-pressure cylinder, and had the piston been tight these would of course have been more marked.

I think we may assume that the nearer the expansion curve in practice approaches that due to the perfect engine, the better will be the performance of the engine, and from these diagrams I have formed the opinion that the limit of beneficial expansion with the two-cylinder compound engine is about reached at a pressure of between 80 lb. and 100 lb. per square inch, and that in order to obtain better results with steam above that pressure we must compound our present compound engines.

I may mention that within the last few weeks there has been a steamer completed to work at a pressure of 150 lb. per square inch with triple expansion engines very similar to those fitted in the *Aberdeen*, and in my opinion this description of engine marks one of the most important of recent advances in the history of marine engineering, affording a means of using steam at higher pressures than have hitherto been used with economy.

SINKING OF THE S.S. AUSTRAL.

The *Austral*, steamer, belonging to the Orient Steam Navigation Company, capsized and sank at her moorings in 40 ft. of water while coaling on Nov. 11.

The sinking of so large and perfectly constructed a vessel as the *Austral*, when lying at rest in harbour, is an unprecedented incident in naval disaster. At the time she was open to public inspection in St. Katherine's Docks, not seven months ago, she was pronounced by experts to be practically unsinkable; and so far her behaviour at sea has justified that assumption. The conditions, however, under which vessels of this size put to sea appear to contribute in a far greater degree to safety than those which prevail when in port.

The *Austral* arrived at Sydney on the 3rd inst. She had steamed at low pressure from the Cape owing to some derangement of her high-pressure valve gear, but still reached her destination within three days of her time. Her cargo was discharged with the exception of 200 tons of iron, and on Friday she was lying in perfect safety at her moorings. Her period of departure had been delayed slightly to enable the high-pressure valve to be repaired, and consequently there was no need of haste on the part of those in charge, either in respect of coaling or taking in cargo. The coaling appears to have been carried on through Friday night, and was going on at four in the morning of Saturday, when the catastrophe occurred. The coal is taken on board steamers of the size and character of the *Austral* through large portholes at the sides of the ship placed below the line of ordinary portholes and furnished with shoots. These coaling portholes are, of course, tightly closed before the vessel puts to sea, but when in harbour they are opened for loading and coaling. In a large harbour, such as Sydney, a swell or breeze might spring up sufficiently menacing to make it advisable to close them even when the vessel is at her moorings, but nothing has reached London to indicate that Sydney harbour was otherwise than calm on Saturday morning. The telegrams state that 1,500 tons of coal had been taken in, and it is certain that had this been trimmed so as to be below the water-line it would have greatly added to the stability of the vessel. If the trimming had been completely neglected it is ascertained by calculation that as much as 1,000 tons of the coal might have remained above the water-line; but, although this would have greatly detracted from the stability of the ship, it would not alone have been sufficient to cause the disaster, nor even to risk the safety of the steamer. We must look, therefore, for some other condition to account for what has happened, and the most feasible hypothesis is suggested by a telegram to the effect that the water ballast had been pumped out before the vessel was in a position to make its removal advisable.

The water ballast is contained in tanks, placed near the keel, and is always pumped in by steam power as the cargo is removed, so as to give the vessel the necessary stability as she is lightened. The *Austral's* tanks were capable of holding 800 tons; and that this was sufficient was demonstrated during the passage of the vessel from the Clyde to the Thames last April, when she carried absolutely nothing but water ballast. The order to pump out the water ballast must have been given on the assumption that the coal taken in had been properly trimmed, because the only excuse for removing the ballast would be that the coal had taken its place. There was, however, nothing to be gained by pumping out the water ballast at this time. The ship was in water sufficiently deep to render the amount of her draught of no consequence.

The coal being untrimmed and the water ballast having been removed, it will be easily understood that the vessel would become top-heavy. Any pressure on the side, arising from either wind or tide, would cause her to lean a little over, and the force exerted by the top weight would then act with greatly increased leverage. If the water ballast had been only partially removed, the danger would be increased, because every addition to the mass of untrimmed coal would cause the vessel to lean and bring the water in the half-filled tanks to the same side to add to the inequality. Immediately the edge of the open coal ports had been brought below the level of the water, even for a few minutes only, the catastrophe was inevitable.

Owing to the fact that the purser, named Perkins, and four of the crew have been drowned, there will be an official inquiry, so that it would be wrong to prejudge the case as against any individual, but it is clear that the vessel must have been grossly mishandled in the process of coaling, and that the disaster is the result of negligence wholly unconnected with questions of construction or navigation. There is too much reason to fear that the cargo having been discharged and the responsibility of the care of passengers being at an end, discipline was relaxed and a feeling of over-confidence in the security of a harbour supervened. We learn from Sydney that the divers are already at work, and suggestions have been made on this side by the underwriters on the ship and others as to the best available means of lifting her. Strong hopes are entertained that it will be possible to raise her before many weeks are past.

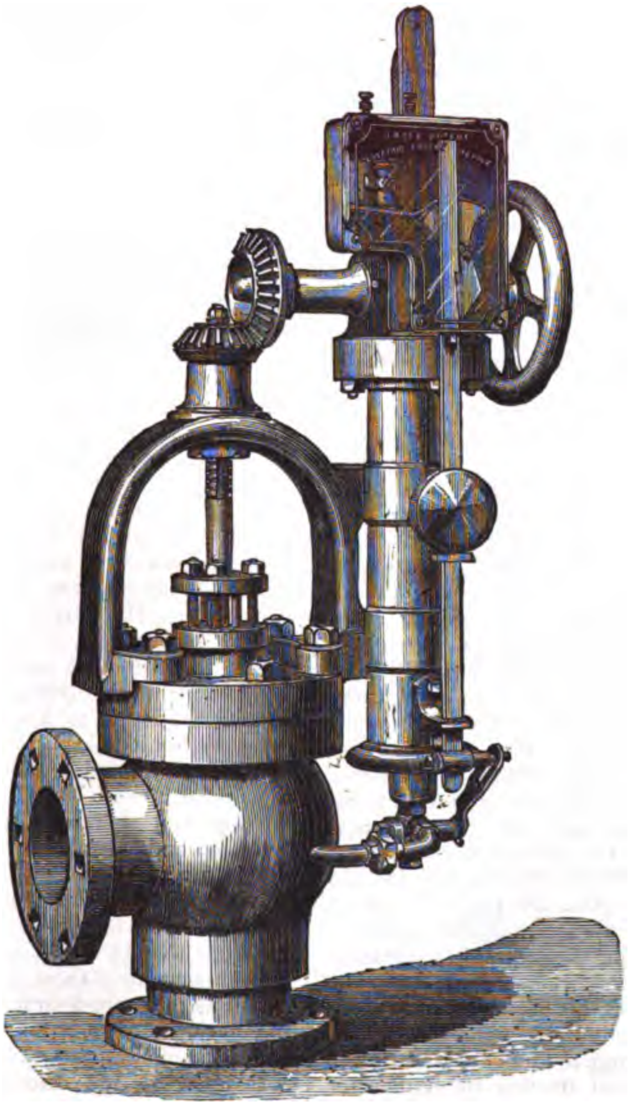
Rumoured New Venture by Messrs. John Elder & Co.—It is understood that negotiations have been opened by Mr. William Pearce, of John Elder & Co., shipbuilders and marine engineers, Glasgow, with the representative of the Earl of Eglinton, for the acquisition of a portion of ground on the Inches at Adrossan, with the view of starting a branch shipbuilding establishment, where a sufficient depth of water might be obtained for launching and fitting out vessels of the largest class of men-of-war.

ELECTRIC APPARATUS FOR CLOSING VALVES AND STOPPING STEAM ENGINES.

THE importance of quickly stopping the engines of ocean steamships and river steamers is a subject which has exercised the inventive powers of engineers for many years. Numerous special kinds of apparatus have been manufactured and applied to assist the engineer in controlling the movements of large and powerful marine engines. These appliances all possess merits of a greater or lesser degree, subject to certain governing conditions, which in some instances are of a very limited nature. In addition to the above remarks concerning marine engines, the same may be said of stationary engines used in factories and workshops.

An important invention has been patented and applied to this purpose to facilitate the general immediate governing conditions in a most remarkable way by introducing the medium of electricity as the primary agent, and appears to possess important advantages not claimed by any other controller.

This new method has been invented by Mr. Tate, of Bradford. The apparatus consists of an ordinary Leclanche battery, an electro-magnet, and wires leading to any position from which it be desirable to control the engine, and buttons for completing the circuit. Also a small steam cylinder, piston-rack, and pinion-gearing, which actuates the stop-valve on the engine. This apparatus is constructed in a neat and compact form, and can be applied to any kind of stop-valve. The electro-magnet is placed at the top, and connected directly to a suspension-rod, which actuates a small steam cock on the cylinder of the apparatus. The circuit is an open one, and when it is desired to put the apparatus in operation, the pressure of the finger on one of the buttons—at any distance from the engine—closes the circuit and excites the electro-magnet, the effect being to release the suspension-rod, which falls with a velocity due to gravity. The suspension-rod in falling opens the small cock of the



cylinder and admits steam; the initial pressure of steam being the same as in the steam engine cylinder. The piston in the cylinders of the apparatus immediately ascends, and the rack piston-rod instantly closes the engine stop-valve. The steam to work the apparatus being taken from the valve-chamber from underneath the valve—*i.e.*, between the valve and the steam engine cylinder—the consequence is that as soon as the stop-valve has been closed there is no longer any pressure in the small cylinder; and when it is desired to start the engine, the engine-driver has simply to lift up the suspension-rod to its normal position and open the stop-valve in the ordinary way. In lifting the suspension-rod the small cylinder cock is again closed against the admission of steam; but the cock having three passages, is opened for the inlet of atmospheric air. The act of opening the stop-valve by the hand wheel operates also on the piston, which falls to the lower end of the small cylinder, and is then reset for further use. When applied to the stop-valves of condensing engines, a cock, fitted on a pipe opening to the atmosphere, is also actuated by the apparatus, and at the instant the stop-valve is closed this cock is opened, thus admitting air into the condenser, destroying the vacuum, and stopping the supply of water. The apparatus also stops the engine on which it is fitted whenever the speed exceeds the ordinary rate by any given number of evolutions. This is effected by means of the throttle or variable expansion valves, actuated by the engine-governor. Short arms fixed on the valve-spindles, which act as fingers to press in a push or button at any time the valve exceeds the usual range of lift or stroke. In all cases the apparatus resets itself when the engine is started.

The arrangement adopted in fitting this invention on board of a ship brings within the reach of any person on board the power of stopping the engine at a moment's notice, thus providing additional facility in averting the dangers of disasters due to collisions, grounding, &c. On every deck, and in every compartment of the ship, buttons may be placed communicating with the electric battery. These buttons are protected by covers of glass, and attached to the frame of each is a small iron rod, suspended by a chain, for the purpose of breaking the glass in an emergency. Buttons without glass covers are placed in convenient positions for the use of the ship's officers, and instead of signalling to the engine-room for the engineer to stop the engines, it is within the power of the captain or other officers to shut off the steam almost instantaneously.

The great advantage of this arrangement cannot be over-rated, as it places power in the hands of the captain or commanding officer in charge to immediately stop the engines without any danger of trusting to systems or codes of signalling, which, by being wrongly handled, or misinterpreted, might lead to great loss of life and property.

We have previously explained the method adopted to prevent an excessive number of evolutions which would be an effectual and automatic preventive of racing in screws in a sea-way, and can only add that in factories, and in all places where stationary engines are used, the advantages of Tate's Patent Valve-Closing Apparatus is equally applicable and useful, as a similar distribution of buttons throughout the factory enables any person in the office, or on any floor or room, to close the circuit of the electric current, and instantaneously stop the engines and machinery independent of the engine-driver.

The great advantages attached to this patent will be clearly evident to every engineer, and we have no doubt that in a very short space of time this exceedingly simple, effective, and handy controller will be extensively adopted.

PATENT CIRCULAR-BALANCED AND DOUBLE-PORTED SLIDE VALVES.

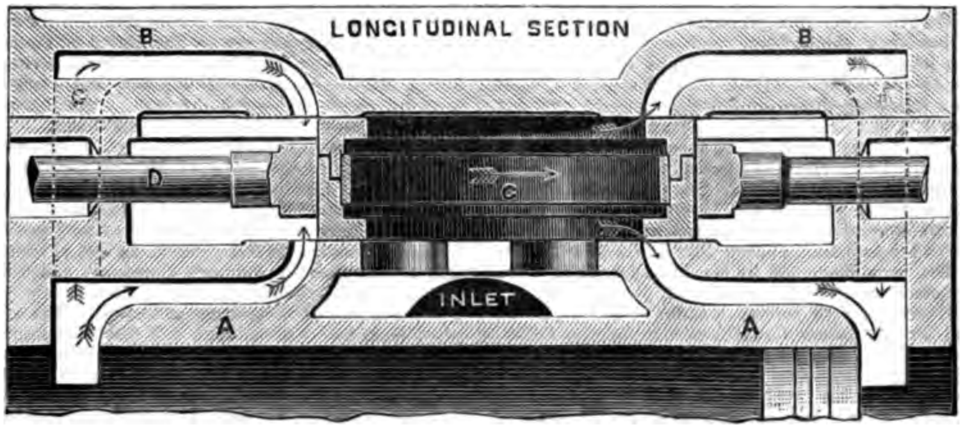
CIRCULAR Slide Valves of various kinds have been frequently used of late, with the anticipation that their freedom to turn round with the hoops by which they are driven would change the relative positions of the rubbing surfaces, and largely reduce the wear and tear of valves and cylinder port faces. This anticipation, however, has not been fully realized. In general practice, circular valves have been used in combination with cylinders provided at each end, with one inlet port only, and in order to give a sufficiency of port-opening, such a combination has compelled the use of valves having a long travel, and the dimensions of which, owing to their circular shape, have been excessively large as compared with rectangular valves of equal capacity.

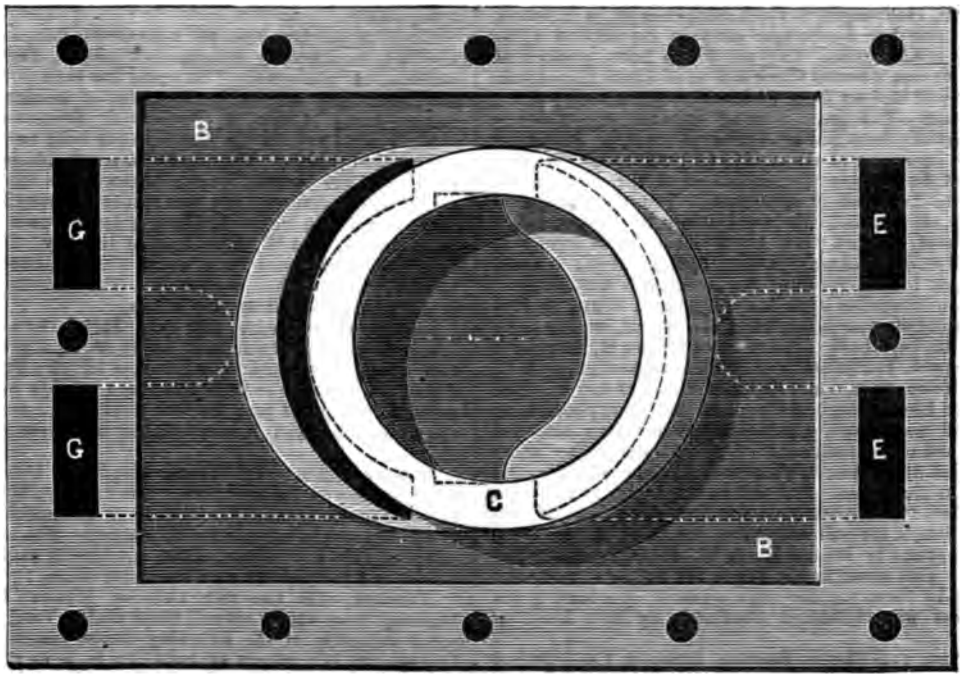
These excessive dimensions have been found in practice difficult to deal with constructively, as they have necessited the use of large, unsightly, and disproportioned valve chests, unduly heavy and expensive to construct, and they have, by adding weight to the valve, and by exposing it, even when partly balanced, to a large amount of back pressure, so greatly impaired its freedom within its driving hoop, and the efficiency of its turning action, as to have materially lessened in many cases the benefits expected to be gained by its use.

The longitudinal section and plan shown in illustration is the invention and patent of Messrs. Payton & Wilson, and represents the detail of their circular-balanced and double-ported slide valves. The object of this invention has been the construction and combination of the several parts of circular valves in such a manner as to largely decrease their dimensions, and at the same time by reducing their weight, their travel, and the pressure upon them, lessen their friction to such an extent as to insure their freedom within their hoops, and the efficiency of their turning action upon their seats. The combination above illustrated has been found by actual practice and extensive use to perfectly accomplish that object. By reference to the drawings it will be seen that the valve is made in two parts or rings, the outer surfaces of which are alike, and form similar but opposite valves, one of which moves upon the cylinder port face and the other upon the inner surface of the valve chest cover, both of which are provided with similar and opposite ports and passages leading to the ends of the cylinder. As the valve in its motion uncovers two opposite ports at the same moment it is obvious that they only need to be one-half the area required when only one port is used, and the travel of the valve and its dimensions may be correspondingly reduced. It will also be seen by the drawings that the valve is, by the method of its construction and without any especial provision for the purpose, formed into a balanced valve of the simplest and most perfect kind. Unlike ordinary valves, the exhaust takes place on the outside of the valve into the valve chest, and steam from the boiler is always present inside the valve, where it presses upon the inner projecting edges of the rings with just sufficient force to keep them in contact with their seats, and any escape through the valve is prevented by the steam expanding the ring covering the junction between the two parts of it.

As the valve is thus subject to little or no pressure the enormous loads, common to ordinary valves, are done away with, and it is, therefore, capable of being moved with the least possible amount of power, and its freedom to turn upon its seats is as great as it can be. Exhausting into the valve chest has the effect of largely increasing the freedom of the exhaust, from the fact that curved ports always have a much larger area opened by a circular valve on its outside than is opened inside of it.

It also has the advantage of removing a considerable amount of pressure from the cover of the valve chest, a point of much importance in large engines.





VALVE AND UNDER SIDE OF COVER IN PLAN

The foregoing description of this invention will show that the combination is that of a circular, balanced, double-ported slide valve, and that a successful endeavour has been made to produce an exceedingly small and simple article which can be easily moved, and is certain to turn upon its faces, whilst it is impossible to be subjected to score or tear. It is also capable of being driven, handled, and reversed with much greater ease than valves of the ordinary kind.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

The Rajore.—On November 18th Messrs. Oswald, Mordaunt, & Co. launched from their shipbuilding and engineering works, Southampton, an iron sailing ship of 2,050 tons register, named the *Rajore*, built to the order of Messrs. Eyre, Evans, & Co., of Liverpool, of the following dimensions, viz.:—Length, 277 feet 4 in.; breadth, 40 ft. 3 in.; depth of hold, 24 ft. 3 in. The ship is built with full poop, monkey forecastle, and large midship house for crew. She is fitted with Harfield's patent windlass for lifting anchors, and all the latest improvements. She is intended to class 100 A 1 at Lloyd's and 20 years in the Liverpool Underwriters' Registry. The ceremony of naming the vessel was performed by Mrs. Lloyd, wife of the captain. During the course of construction the vessel has been inspected by Mr. Malcolm, and, when fitted out, will be commanded by Captain Lloyd.

Scorton.—On November 23rd Messrs. Readhead & Co., South Shields, launched a new steamer for Messrs. Chapman & Miller, of Newcastle. The vessel, which was named the *Soorton*, is 2,200 tons, and 259 feet long.

Daylesford.—On November 23rd Messrs. Robert Thomson & Sons launched from their yard at Southwick-on-the-Wear a steamer built to the order of Messrs. Thompson & Wrightson, the managers of the "Standard" series of limited liability shipping companies at Sunderland. The *Daylesford*, as the new vessel was christened by Mrs. Halfknight, is 250 ft. long over all, 34 ft. broad, and 17 ft. deep, and her deadweight carrying capacity on 17 ft. draught of water is 1,800 tons. Engines of 130 horse power will be supplied by Messrs. Thomas Clark & Co., of Elswick-on-Tyne. The *Daylesford* will load for New York with a general cargo.

The Collingwood.—The great ironclad barbette ship *Collingwood* was successfully launched on November 22nd, at Pembroke Dockyard. The ceremony of christening was performed by Mrs. Chatfield, wife of the Captain-Superintendent of the yard, in the presence of many thousands of spectators. The *Collingwood* is 325 ft. long and 68 ft. wide. Her engines are by Messrs. Humphrys and Tennant, and are 7.000 horse power. Her armour is from 16 in. to 18 in. in thickness, the total weight of the armour-plating being 1,497 tons. Her total displacement is 9,150 tons.

Hartburn.—On November 25th Messrs. Edward Withy & Co. launched from Middleton shipyard, West Hartlepool, an iron screw steamer, which has been built to the order of Messrs. R. Ropner & Co., West Hartlepool. Her principal dimensions are:—Length B.P., 275 ft. beam, extreme, 35 ft. 6 in.; depth moulded, 21 ft. 2 in. She has been built to Lloyd's highest class, and has short poop, long quarter deck, and chart-house, with top-gallant forecastle extended over fore-hatch and to the foremast. She has water ballast under each hold, and her decks, masts, chart-house, engine, skylight, and cabin companions are of iron. She will be fitted with four hatches and steam winches, two donkey boilers, patent windlass, and will be rigged as a double top-sail schooner. Engines of 200 horse power will be supplied by Messrs. R. & W. Hawthorn, of Newcastle-on-Tyne. This vessel is No. 114 in the builder's yard, and the fourth built by them for the same owners. On leaving the ways the steamer was christened *Hartburn*, by Miss Field, of Preston.

Cairo.—On Nov. 25th Messrs. Raylton, Dixon, & Co. launched from their Dockyard, at Middlesbro', one of the finest vessels that has yet been built there, her unusually fine lines and handsome model having attracted considerable attention during her construction. She is a very similar vessel to the tea steamer *Minard Castle*, built about a year ago, her dimensions being:—Length, 340 ft.; breadth, 38 ft. 6 in.; and depth of hold, 26 ft, and capable of carrying 4,000 tons of tea besides her coals and stores. She has been built on her builder's own account, and will be finished in the highest style suitable for passenger traffic or first-class trades. Her engines are of 300 horse power, from the well-known works of Messrs. Richardson, of Hartlepool. On leaving the ways the vessel was christened the *Cairo, pro. tem.* by Miss Bessie May Dixon, of Gunnergate Hall, the daughter of the builder. The *Cairo* is the sixteenth vessel launched by Messrs. Dixon during the present year, and they intend launching on December 9th H.M.S. *Dolphin*, and at the latter part of the month a large Spanish steamer.

Westmeath.—On the 11th Nov. a screw steamer named the *Westmeath*, was launched from the yard of the Sunderland Shipbuilding company, at the South Docks. The steamer is to the order of Mr. R, M. Hudson, of Sunderland. Its dimensions are:—Length, 330 feet; breadth 42 feet; and depth, 30 feet. She will be of the highest class at Lloyd's with considerably extra strength, and her tonnage will be about 3,200 gross. The engines are to be fitted by Messrs. Doxford & Sons, of Pallion, and wil be of 40 and 74 inches diameter cylinders, and 48 inches stroke. The *Westmeath* will have accommodation for passengers, and be certified for that purpose by the Board of Trade. She will have Messrs. Emerson Walkers patent direct acting steam windlass, steam steering-gear, steam winches, and everything required for working cargo and quick despatch. As the vessel glided from the ways she was christened by Miss Pallister.

King's Cross—On the 11th Nov. a screw-steamer, *King's Cross*, built to the order of Messrs. George Loram & Sons, Mark Lane, London, was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Co. (Limited). The dimensions of the steamer are:—Length between perpendiculars, 283½ feet; breadth, moulded, 86 feet; depth, 24 feet 4½ inches. Her engines will be supplied by Palmer's Company, and will be of 180-horse power nominal, the cylinders being respectively 35 and 64 inches, and the stroke of the piston 42 inches. The steam will be supplied from two boilers, each 13½ feet diameter and 10 feet long, with a pressure of 80 lbs. to the square inch, all the most modern improvements, including Winches, Emerson, Walker & Co. direct steam windlass, and the necessary requirements for the rapid loading and discharging of cargo, the trade for which she is intended being the general carrying trade. Her building has been superintended by Mr. Loram, jun. The ceremony of christening the ship was performed by Mrs. George Loram, wife of the managing owner.

Carbis Bay.—On Nov. 11, a screw-steamer, named the *Carbus Bay*, was launched by Messrs. Schlesinger, Davis, & Co., shipbuilders, of Wallsend. This vessel has been built to the order of the Carbis Bay Steamship Company, of Penzance, the managing owners being Messrs. F. Banfield & Sons, for whom Messrs. Schlesinger, Davis & Co. have already built two steamers within a very short period. The *Carbis Bay* will obtain Lloyd's highest class, and her leading measurements are as follows: Length between perpendiculars, 265 feet; breadth moulded, 36 feet; and depth of hold, 19 feet. Engines of large power will be supplied by Messrs. R. and W. Hawthorn of this city. Both vessel and machinery have been built under the superintendence of Mr Michael Scott, of North Shields. The ceremony of naming the vessel was performed by Miss Hinks.

Lizard.—On Saturday, 30th Oct., Messrs. Edward Finch & Co., Limited, launched from their upper ways, a powerful tug boat. Her principal dimensions are:—75·0 length; 15 ft. breadth; and depth, 9 ft. She is to be adapted as a salvage boat, fitted with a powerful pump and gear for lifting anchors. She was christened the *Lisard*, by Miss Rowe, daughter of Messrs. Finch's managing director.

A ferry steamer, by Messrs. Hepple & Co., North Shields, was launched on October 26th. She has been built for the Tyne Commissioners to meet the increasing passenger and conveyance traffic between North and Sorth Shields. She will be fitted with a pair of side-lever disconnecting condensing engines of 60 horse-power, and the paddles with feathering floats.

Henrietta.—On the 26th October, Messrs. Turnbull & Son, launched from the Whitehall Shipbuilding Yard, Whitby, an iron screw steamship of the following dimensions:—Length, 240 ft.; breadth, 34 ft.; depth of hold, 17 ft. 9 in.; with a carrying capacity of about 1,950 tons. The engines of 120-horse power, are by Blair & Co., of Stockton. The vessel is built with raised quarter-deck, bridge house and top-gallant forecastle, and is fitted with double bottoms throughout both holds, four steam winches, Emerson & Walker's patent windlass, steam steering gear, and all recent improvements. She has been built to the order of Messrs. Best, Ryley & Co., of London, and was christened the *Henrietta* by Miss Pease, daughter of A. Pease, Esq., M.P. for the borough of Whitby.

Sculptor.—On the 28th October there was launched from the yard of Messrs. Raylton Dixon & Co., Middlesbrough, a steamer, which was named the *Sculptor*, for Messrs. T. & J. Harrison, of Liverpool. The vessel is built to class 100 A 1 at Lloyd's, and also to have Board of Trade passenger certificate, and is of the following dimensions:—Length, 260 ft.; breadth, 33 ft.; depth moulded, 21 ft. 7 in.; and will have a dead weight carrying capacity of over 1,900 tons. She has lower deck laid with wood, main deck with iron covered with wood, poop and forecastle, long bridge, with accommodation for officers and engineers, schooner-rigged, with pole masts. Her engines, of 120-horse power nominal, will be fitted by Messrs. Blair & Co., Limited, of Stockton. On leaving the ways, she was christened the *Sculptor* by Mrs. Hutchinson, of Ayton.

Violante.—On October 28th, Messrs. Edward Finch & Co., Limited, launched successfully from their yard, at the Bridge Works, Chepstow, a very superior modelled, built and arranged iron steamer, for Messrs. Cuthbert & Hancock, Cardiff. Her principal dimensions are 200 ft. length; 30 ft. beam; and 15 ft. depth of hold, with a dead weight capacity of about 1,100 tons. She will be fitted with Clyde built engines, and all the latest and most improved arrangements for economy in working and despatch; is built of Dowlais iron, and is classed 100 A 1 at Lloyd's. The launch, which was a most satisfactory one, was witnessed by several hundreds of persons. The vessel was christened as she left the ways *Violante*, by Mrs. Hancock.

Sir Garnet Wolseley.—On the 28th October, there was launched from the yard of Palmer's Shipbuilding and Iron Company, Jarrow, a new steamer, built to the order of Messrs. Simpson & Page, of Newcastle. The steamer, which, it may be stated, is the first built for this firm, is of the following dimensions, namely:—Length over all, 303 ft.; length between perpendiculars, 292 ft.; breadth, 37½ ft.; depth moulded, 26 ft. Her dead weight carrying capacity will be about 3,500 tons, and she has been built under special survey to class 100 A 1 at Lloyd's. She is fitted with Emerson, Walker, & Co.'s patent windlass. Her engines will be of about 1,250-horse power effective, the cylinders being respectively 36 and 68 in.; and the stroke of the piston 45 in. She was named *Sir Garnet Wolseley* as the left the ways.

Inchgarvie.—On October 28th Messrs. C. Mitchell & Co. launched from their yard at Low Walker, Shields, the *Inchgarvie* (s), for the Inch Line of steamers, owned by Messrs. Hamilton, Fraser & Co., Liverpool. This is the seventh Inch steamer constructed by Messrs. Mitchell, and the vessel will carry upwards of 4,000 tons deadweight of cargo. The machinery has been constructed by Messrs. R. & W. Hawthorn, of Newcastle.

Cerdic.—On October 28th Messrs. M. Pearse & Co. launched from their iron shipbuilding yard, at Stockton-on-Tees, an iron screw steamer of the following dimensions, viz.:—Length, 255 ft.; breadth, 35 ft.; depth, 18 ft.; about 1,550 tons gross register, and classed 100 A1 at Lloyd's. Her engines will be 140 horse power nominal, by Messrs. Blair & Co. As he left the ways the name of *Cerdic* was given to her by Mrs. Kay, wife of the managing owner. This is the eighth steamer Messrs. M. Pearse & Co. have built for Richard J. Kay, Esq., of Birtley.

Newcastle City.—On the 28th October Messrs. Edward Withy & Co. launched from their Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Mr. C. Furness, of West Hartlepool and Newcastle. This vessel is No. 113 in the builders' books, and her principal dimensions are:—Length B. P. 285 ft.; beam extreme, 36 ft.; depth of hold, 24 ft. 3½ in.; and the deadweight carrying capacity will be about 3,100 tons. She is built to Lloyd's three-decked rule, and has poop, bridge, and topgallant forecastle, double bottom for water ballast under both holds, upper deck of yellow pine, and main deck of iron. She will be fitted with four steam winches, two donkey boilers, and direct-acting steam capstan windlass, and will be rigged as a two-masted double topsail schooner, with iron lowermasts. She has been built under Lloyd's special survey for the 100 A1 class, and under the personal superintendence of Captain T. King. Engines of 200 N horse power, with two boilers, will be fitted by Messrs. T. Richardson & Sons, Hartlepool. This is the seventh steamer built at this port for the same owner, who has two more building. On leaving the ways vessel was christened *Newcastle City* by Mrs. C. Furness.

Normandie.—On October 28th the new steamship *Normandie* was launched from the yard of the Barrow Shipbuilding Company. The steamer has been built for La Compagnie Generale Transatlantique. She is 473 ft. over all, 50 ft. beam, 47 ft. 5 in. depth, and is fitted with new engines of the inverted compound direct-acting type, with three cylinders high pressure 35½ inches, and three lower pressure at 75 inches, working on three cranks with a 67-in. stroke, and a powerful direct steam windlass, with capstan on upper deck, Emerson, Walker & Co.'s patent. The vessel is 6,000 tons burthen, and carries 200 first and second class passengers, besides 1,000 steerage.

Gondola.—On the 28th Oct. Messrs. Pickersgill & Sons launched from their shipbuilding-yard, Southwick, Sunderland, an iron screw steamer built to the order of Messrs. John P. Ninnes & Son, Cardiff, of the following dimensions:—Length, 255 ft. between perpendiculars; breadth, 35 ft.; depth, 17 ft.; and classed 100 A 1 at Lloyd's. The vessel has been built under special survey. Her engines will be of 140-horse power nominal, by Mr. G. Clark, of Southwick, and patent windlass by Messrs. Emerson, Walker & Co. This steamer is especially adapted for the Danube, shallow Black Sea ports, and Bilbao iron ore trade. She will be fitted with all the necessary fittings to pass the Board of Trade for grain cargoes. As she left the ways the name of *Gondola* was given her by Mrs. Smiles, the wife of Mr. T. J. Smiles, of Huddersfield. This is the second steamer built by the above firm for Messrs. Ninnes & Son.

Tomki.—On the 28th Oct. Messrs. R. and H. Green launched from their shipbuilding yard at Blackwall a steel twin-screw steamer, built to the order of Messrs. Watt, Gilchrist & Co., East India Avenue, and intended for the service of the Clarence and Richmond Rivers Steam Navigation Company, of Sydney, New South Wales. She is a flush-decked vessel, with bridge amidships, and is of very light draught, having been specially designed for very shallow bar harbours and rivers. The dimensions of the vessel are as follows:—Length between perpendiculars, 180 ft.; breadth, moulded, 27 ft.; depth in hold, 15 ft.; draught of water with 200 tons deadweight cargo, 7 ft. 6 in. She has cabin accommodation aft under deck for 36 gentlemen, and on deck a house for 14 ladies, steerage accommodation forward for 33 males and 12 females. She is fitted with a water ballast tank aft to hold 60 tons of water, and fresh water tanks for 2,000 gallons. The vessel will be propelled by two pairs of compound direct-acting surface-condensing disconnecting twin screw engines of 500 indicated horse-power, to be supplied by Messrs. Thomas A. Young & Son, of Blackwall. The ceremony of christening the vessel the *Tomki* was performed by Miss Alger, daughter of John Alger, Esq., chairman of the company. This is the tenth steamer built in England for the above company, which was established in 1853.

Norman Prince.—On the 30th Oct. there was launched from the yard of Messrs. Hodgson and Soulsby, at Blyth, the schooner-rigged iron steamer *Norman Prince*; tonnage about 1,041 u.d., 1,303 g., and 825 n.; length 242 ft., breadth 33 ft., depth 17 3-12 ft. She was built to the order of Mr. J. Knott, of Newcastle. The vessel has inverted direct acting compound screw engines of 125-horse power, 29½ in. by 55 in. with 36 in. stroke, made by Black, Hawthorn & Co., Gateshead.

Chirton.—On the 30th Oct. Messrs. T. and W. Smith launched from their yard, at North Shields, an iron screw steamer of the following dimensions:—Length, 225 ft.; breadth, 33 ft.; depth of hold, 15 ft.; with engines of 100-horse power, which will be fitted by the Wallsend Slipway Company. The vessel is intended to carry 1,500 tons, and is classed 100 A 1 at Lloyd's. She will be fitted with all the latest improvements. The steamer, which was named the *Chirton*, has been built to the order of Messrs. Eskdale, Dodds & Co., North Shields, and will be employed in the Bilbao and general carrying trades. Miss Jennie Dodds christened the vessel.

Gwendoline.—On October 30th, there was launched from the Howdon yard of Palmer's Shipping and Iron Company this screw steamer, which is intended for the Mediterranean line of Messrs. John Wilson & Co., of London. She measures 270 ft. long, 35 ft. broad, and. 20 ft. deep, and is fitted with all the most modern appliances, including patent windlass, Emerson, Walker & Co.'s patent.

Allonby.—On October 8th, Messrs. Robert Thompson & Sons launched from their shipbuilding yard at Southwick, Sunderland, an iron sailing barque, built to the order of Messrs. Peter Iredale & Son, Liverpool, and of the following dimensions, viz.:—Length, 240 ft.; breadth, 38 ft.; and 21 ft. 9 in. depth of hold. She has been constructed under Lloyd's special survey for the highest class, and the personal superintendence of Captain Penny. The vessel has raised quarter-deck and monkey forecastle, large iron deck-house amidships, with accommodation for crew and apprentices; cabin aft for captain and officers, and spare berths. She is intended for the India and China trade. All the latest improvements have been introduced on board, and the fittings throughout are of the best style. As she left the ways she was named the *Allonby*.

On October 8th, a screw steamer was launched from the shipbuilding yard of Messrs. Kish, Boolds & Co., Sunderland. The vessel has been built to the order of Mr. James B. Hick & partners, Scarborough, and is of the following dimensions:—Length, 240 ft.; breadth, 34 ft.; depth, 16.6 ft., with long raised quarter deck, bridge, and topgallant forecastle, and has water ballast tanks throughout on the cellular principle, She has been specially designed to carry a large cargo on a light draught, having flat plate keel and bilge rolling keels, and has been built under the special survey of Lloyd's, for the 100 A 1 class, and under the personal supervision of Captain Thomas Simpson, of Filey, who will take command. The accommodation for the captain, officers, and engineers is placed amidships under the bridge. She has been fitted with all the most modern appliances for ensuring quick despatch in loading and discharging, having four powerful steam winches, with large donkey boiler, by Welford Bros., Harfield's patent windlass, Cooper & Taylor's steam steering gear, and Hastie's right and left hand screw gear aft. The engines, which are to be supplied by Messrs. Wm. Doxford & Sons, are on the compound surface condensing type, of about 130-h.p. nominal.

ON November 11th, an iron screw steamer was launched from Messrs. Richardson. Duck & Co.'s yard at Stockton, built to the order of Messrs. T. Binnington & Co., of Stockton. She is 259 ft. long, 36 ft. 3 in. broad, and 23 ft. 6 in. deep, and has a gross tonnage of 1780 tons. Messrs. Blair & Co., of Stockton, will supply her with engines of 150 horse power nominal.

Bay of Aboukir.—On the 11th Nov. there was launched from the yard of Messrs. Wigham Richardson & Co., Newcastle-on-Tyne, for Messrs. W. W. Long & Taylor, of Liverpool, the iron screw steamer *Bay of Aboukir.* The dimensions of the vessel are 310 ft. over all, 300 ft. between perpendiculars, 37 ft. breadth of beam, and 27 ft. depth of holds. She has been built under special survey to the spar-decked rule, but with extra strength, will be classed 100 A at Lloyd's, has two iron decks laid, the spar deck being sheathed over with wood. The engines, also by Messrs. Wigham Richardson & Co., are on the compound principle, cylinders 38 in. and 72 in., stroke 48 in. The vessel will be fitted with all the latest improvements, including patent distiller for fresh water, steam windlass, steering gear, steam pump, four powerful steam winches, water ballast, &c., and will have accommodation for 12 first-class passengers in large deckhouse aft. She has also 'tween decks side lights, fitting her for either transport or emigrant service. The accommodation for the captain will be in the deckhouse aft, for officers and engineers under bridge amidships, and for crew in forecastle. The vessel will be supplied with all the necessary spare gear, and is intended for general trading. The ceremony of naming the vessel was performed by Miss Taylor, of West Hartlepool. After the launch the *Bay of Aboukir* was taken alongside the engine works of Messrs. Wigham Richardson & Co. to have her machinery put on board.

Ednyfed.—On November 11th Messrs. Doxford & Son launched from their shipbuilding yard, Pallion, Sunderland, a sailing vessel, built to the order of Mr. R. Thomas & Co., of Criccieth, Wales. The dimensions of the vessel are:—Length, 220 ft.; breadth, 35 ft.; and depth, 21 ft.; of about 1,120 tons gross. She has been built under special survey, with extra thickness of iron, beyond Lloyd's requirements, in bilge plates and sheer strake, has Harfield's patent windlass, and is to be fitted out with a full and complete East India outfit, with all the latest improvements, and is classed 100 A 1 Lloyd's. As she left the ways, in the absence of the managing owner's wife, the christening ceremony of naming her *Ednyfed* (after the residence of one of the owners) was performed by Mrs. Davies, wife of the master of the Sunderland Workhouse. The *Ednyfed* is to be commanded by Captain Owen Jones, late of the *Acorn.*

J. M. Lockwood.—On November 11th William Gray & Co. launched from their South Yard, at West Hartlepool, an iron screw steamer of the following dimensions.—Length, 263 ft.; breadth, 35 ft. 6 in.; depth, 19 ft.; class 100 A 1 at Lloyd's; to the order of John Murrell & Co., West Hartlepool, She is intended for the Indian and general trade, to carry about 2,350 tons, and is fitted with double bottom for water ballast, and all recent improvements in steam winches, &c, for rapid discharge of cargo, and patent windlass for working anchors, Messrs. Emerson, Walker & Co.'s patent. The engines, which are 150-horse power, are being supplied by Messrs. Black, Hawthorn & Co., Gateshead. On leaving the ways the christening ceremony was performed by Miss Murrell, daughter of the managing owner, the vessel being named *J. M. Lockwood.* She will be commanded by Captain B. B. Murrell.

Deerhound.—On November 11th there was launched from Messrs. W. Gray & Co.'s North Yard, West Hartlepool, an iron screw steamer similar to the *J. M. Lockwood*, built to the order of Messrs. Callender, White & Hunter, of Hartlepool, fitted with winches, &c., for rapid discharge of cargo, and patent windlass for working anchors, Messrs. Emerson, Walker & Co.'s patent. The engines, which are 150 horse power, being supplied by Messrs. Blair & Co. (Limited), Stockton-on-Tees. On leaving the ways the christening ceremony was performed by Mrs. John Hunter, jun., of Hartlepool, the vessel being named the *Deerhound.*

Cousins Arbib.—On November 13th there was launched from the shipbuilding yard of Messrs. Raylton Dixon & Co., Middlesborough, an iron steamer, which was named the *Cousins Arbib*, of the following dimensions, which has been built to the order of Messrs E. & E. Arbib, of London:—Length over all, 279 ft.; breadth, 35 ft.; depth of hold, 24 ft. 3 in. Her deadweight capacity will be about 2,700 tons. She is built on the three-deck rule, with main deck of iron, water ballast in main and after holds, with poof aft for accommodation of officers and passengers; also a long bridge, with accommodation houses underneath. She is fitted with steam steering gear and all the latest improvements in this class of vessel. Her engines will be of 170 horse power, and are by Messrs. Richardson & Son, of Hartlepool. The vessel and engines have been built under the superintendence of Mr. Casey, of London, who was present on behalf of the owners at the launch.

Monkseaton.—On November 13th an iron screw steamer was launched for Messrs. Elliott, Lowrey, & Dunford, Newcastle, by Messrs. G. S. Swan & Hunter, Wallsend. The vessel is 325 ft. between perpendiculars, by 40 ft. by 26 ft. 6 in. deep, and will be fitted with engines 38 by 71 and 48 in. stroke, with two double-ended boilers, made by Messrs. R. & W. Hawthorn, Newcastle. The vessel was named the *Monkseaton* by Miss Swan, of Tynemouth, and is the third steamer built for Messrs. Elliott, Lowrey, & Dunford, by the same builders.

Clive.—On the 15th Nov. the new Indian troopship *Clive* was floated from the shipbuilding works of Messrs. Laird Brothers, Birkenhead, in the presence of an immense concourse of spectators. The Countess of Sefton performed the ceremony of naming the new troopship, and the prelude to the release of the *Clive* was the reading by the Rev. John Leach, rector of Kirby, of the form of prayer used for her Majesty's ships. It may be stated that in 1879 the Secretary of State for India in Council, having determined to provide the Government of India with a screw steam-vessel for the transport of troops, furnished several of the leading shipbuilders in this country with an outline specification of requirements received from India, and invited competitive designs and tenders for her construction. The plans and estimates submitted in response to this invitation were forwarded to India for the consideration of the Viceregal Government, and the design submitted by Messrs. Laird, of Birkenhead, having been adjudged the best suited to carry out the requirements of the intended service, that firm was in due time entrusted with the order for the construction of the vessel and her machinery; and after the most careful further consideration by the India-office, in conjunction with the Admiralty and Messrs. Laird, matters were so far advanced that the plans were finally approved, and work commenced in February, 1881. The *Clive* is constructed partly of iron and partly of steel; she has three decks, with poop and forecastle connected by side houses, which give uninterrupted communication from stem to stern for working the ship, and afford convenient stowage for boats and other necessary fittings, and is not unlike the fine large Indian troopers, one of which, the *Euphrates*, was built and engined by Messrs. Laird. There is an inner watertight skin forming a double bottom, and there are numerous watertight bulkheads, five of which are carried to the maindeck, and all carefully fitted, where necessary, with watertight doors. Water ballast can be carried in the compartments of the double bottom to trim the ship, as coals or stores are consumed. She has a straight stem and elliptic stern, with sham galleries, and will be rigged as a barque, and have one funnel. The various fittings, arrangements, and outfit of the ship in every department of hull and machinery are of the most perfect and approved description, all the improvements an appliances conducive to comfort and safety having been adopte and carried out in a manner equal to any troop vessels built f her Majesty's service. The ventilation has received the most car ful consideration, and is obtained by means of large side ports a scuttles and square trunk ways from upper deck above the level the poop and forecastle to each space below deck, with t ventilators and cowls for carrying off the heated air, and also an arrangement of tubes through which the foul air will be dr by means of fans worked by steam, or by the current induce the heated gases passing up the funnel, which is double. woodwork throughout the entire ship is of East India teak. *Clive* will have accommodation for 640 military officers and 137 ladies, servants, soldiers' wives, and children, and 140 folk in addition to a crew of 166 officers and men all told, or complement of 1,083 persons; or when occasion requir carries 130 horses, for which special fittings are provided. dimensions of the vessel are:—Length, 300 feet; breadth, 8 inches; depth in hold to upper deck, 25 feet 6 inches; tonnage builders' measurement, 3,003 tons; gross measurement. 2,730 tons; the mean load draught will be 16 feet 6 inches; and the speed on trial, with all weights on board, is to be 12 knots. The engines are a pair of direct-acting inverted-cylinder compound engines, to indicate 2,000 indicated horse power on trial; the cylinders are 48 and 84 inches in diameter, and have a stroke of 4 feet. The boilers are cylindrical, four in number, to work at 75 lbs. pressure, and proved to 150 lbs.

LAUNCHES.—SCOTCH.

Glenfyne.—On October 26th there was launched from the shipbuilding yard of Messrs. A. Stephen & Sons, of Dundee, a steel barque named the *Glenfyne*, built to the order of Messrs. W. and O. Taylor & Co., of Dundee. Her dimensions are:—Length, 206 ft. 7 in.; breadth, 34 ft. 1 in.; depth of hold, about 19 ft.; tonnage, 955 gross. Besides her hull, the masts, yards, &c., are also to be of steel, and she will have wire rigging. She has been fitted up with all the latest improvements for the loading and discharge of cargo, and it is expected that she will carry about 1,600 tons dead weight of cargo. She has Emerson, Walker & Co.'s patent lever windlass. A large number of persons assembled to witness the launch, and on leaving the ways the vessel was christened the *Glenfyne* by Miss Lizzie Robertson, of Balmore, Newport. She is the sixth vessel which the Messrs. Stephen have built for the same owners, and the sister ship to the *Glenfyne* will be launched in about a month.

Alessandro.—On October 26th there was launched from the shipbuilding yard of Messrs. Pearce Brothers & Co., of Dundee, a steamer named the *Alessandro*, built to the order of Messrs. John Thompson & Co., of London. Her dimensions are:—Length, 145 ft.; breadth, 23 ft.; depth of hold, 12 ft. 2 in.; gross tonnage, 356. She has been classed 100 A1 at Lloyd's, and will be supplied with engines of 70 horse power. As the vessel left the ways she was gracefully christened the *Alessandro* by Miss E. Wilmott Boase, Claverhouse. After the launch, Messrs. Pearce Brothers entertained a company of ladies and gentlemen to cake and wine, when "Success to the *Alessandro*" was proposed by Mr. H. J. Pearce, and replied to by Captain Sturlese, who has been appointed to the command of the steamer. "The Health of the Builders" was proposed by Mr. Hall, of Leith, Messrs. Thompson & Co.'s Engineer Surveyor, and suitably acknowledged by Mr. R. A. Pearce. Amongst those present were Mr. William Cox, Mr. Henry Cox; Mr. Albert Pile, of London; Mr. Turnbull, &c., &c.

Sumatra.—On the 26th October, Messrs. Russell & Co., shipbuilders, Greenock, launched from their shipbuilding yard, an iron sailing ship of about 1,600 tons register, and a dead weight capacity of 2,600 tons. The dimensions are as follow:—Length between perpendiculars, 248 ft.; breadth, 38 ft.; and depth of hold, 22 ft. 9 in. The vessel, which has been built to the order of Messrs. Peter Dennistoun & Co., shipowners, Glasgow, is fitted with Emerson & Walker's patent capstan windlass, and fitted up with all the latest improvements for the rapid loading and discharging of cargo, and is classed 100 A 1 at Lloyd's. On leaving the ways she was named the *Sumatra* by Mrs. Clarkson, wife of Mr. Robert Clarkson of Terevon, Polmont. After the launch the *Sumatra* was towed to Port Glasgow, where she will be fitted out for sea. We understand that she will load a cargo of coal at that port for Rangoon.

Chiapas.—On October 27th Messrs. James and George Thomson launched from their shipbuilding-yard at Clyde-bank a steel screw steamer to the order of the "Direct Line," plying between Glasgow and the West Indies (managed in Glasgow by Messrs. David Caw & Co.). Her dimensions are:—Length, 275 ft.; breadth, 33 ft.; and depth, 23 ft. These dimensions will give a gross tonnage of at least 2,000, and enable the owners to ship a cargo of some 2,500 tons deadweight. The indicated horse-power will be at least 1,500, giving her over 12 knots. The new vessel was named the *Chiapas* by Miss Robertson.

Colonsay—On October 28th there was launched from the shipbuilding-yard of Messrs. William Hamilton & Co., Port Glasgow, a steel screw steamer of the following dimensions, namely:—Length between perpendiculars, 240 ft.; breadth, 33 ft.; depth, 14 ft. 3 in.; to carry 1,580 tons deadweight on 15 ft. draught. This steamer is built on the cellular principle, and with all the latest appliances for facilitating loading and discharging. On leaving the ways she was named the *Colonsay* by Miss Law, of Glasgow. This vessel will be fitted with compound surface-condensing engines of 140-horse power nominal, having all the modern improvements. She has been built to the order of Messrs. John Allan & Co., Glasgow, and is intended for the Spanish ore trade.

Pinmore.—On Oct. 28th Messrs. J. Reid & Co. launched at Port Glasgow the largest sailing ship by 300 tons yet built. She is named *Pinmore*, and constructed of steel, and of the following dimensions:—Length, over all, 325 ft. 6 in.; breadth of beam, 43 ft. 10 in.; depth of hold, 25 ft.; 2,800 tons B.M., 2,358 nett register, and capable of carrying 4,000 tons deadweight. She is furnished with steel decks sheeted over with wood, and is overwise constructed considerably in excess of Lloyd's rules. The *Pinmore* is owned by Messrs. John Kerr & Company, of Greenock, and is the sixth vessel built by Messrs. J. Reid & Co. for the same owners.

Leander.—On October 28th Messrs. Robert Napier & Sons launched from their shipbuilding establishment at Govan this steamer, the first of three fast steam cruisers which they are building for the British Government. The dimensions of all the three vessels are the same—namely, length between perpendiculars, 300 feet; breadth, extreme, 46 ft.; depth, moulded, 27 ft. 3 in. The load draught of the *Leander* class is estimated to be 17 ft. 6 in. forward and 20 ft. 6 in. aft, and the corresponding displacement is 3,800 tons. The engines of the *Leander* class, which are also being built by Messrs. R. Napier & Sons, are twin-screw, horizontal compound surface-condensing engines, the diameters of cylinders being 42 in. and 78 in. in each engine, with 4 ft. stroke. The engines are placed in two engine-rooms, enclosed by watertight bulkheads. The boilers are of steel, eight in number, of the return tubular type. Each boiler has three furnaces, which are fired from a fore and aft stokehole at the centre of the vessel, the working pressure of steam being 90 lb. The diameter of each boiler is 13 ft. 6 in., and the length 13 ft. 6 in. The boilers are placed in two boiler-rooms immediately before the engines, and are enclosed by water-tight bulkheads. The total length of space occupied by the engines and boilers and the athwartship bunkers at the after end of engines and at the fore end of the boilers amounts to nearly one-half the total length of the ship; and when we state that not only is this length occupied, but that with the exception of a passage of about 8 ft. on each side of the lower deck between the side bunkers and the hatchway and ventilation casings, and a few cross passages, the propelling power and its fuel demands the whole depth from the keel to the upper deck, one can form some idea of the sacrifices of space which have to be made to obtain high speed combined with great coal endurance. The armament of these vessels differs greatly from that of the *Iris* in its arrangement, and is of quite a novel description. It consists of ten 6-in. breechloading guns, two Gatling guns, six Nordenfeldt guns, and ten Whitehead torpedoes. Four of the breechloaders are mounted on what is known as the Albini carriage, and are fixed on revolving turntables, which project beyond the sides of the ships. They are placed on either side of the upper deck at the fore end of poop and after end of forecastle. These bow guns can be trained from a cross fire of 4 degrees forward to 45 degrees abaft the beam, and the after guns from right aft fire to 45 degrees before the beam. The remaining six 6-in. breechloading guns which these vessels carry are fitted at broadside ports on the upper-deck in the ordinary way. The six Nordenfeldt guns are fitted in projecting parts of the topsides, and are so arranged as to give great training and great depression for firing into boats alongside. The shot used with these murderous weapons is of steel, 1 in. diameter, and pointed. Each gun is capable of firing 250 rounds per minute. The Whitehead torpedoes are discharged from broadside ports on the lower deck—2 forward and 2 aft. These torpedoes are about 18 ft. long and 14 in. diameter. The heads, which contain the explosive material, are stowed in a separate magazine; and the body of the torpedoes, in which are the chambers for compressed air, the engines, screw propeller, rudder, &c., are stowed in a separate store-room. Each vessel has the usual number of boats, and in addition carries two second class torpedo boats stowed on skid beams. In order to mimimise the danger from fire and splinters in time of action, as little wood as possible is used in these vessels. The sides are lined with thin steel sheets, and the cabin bulkheads are made of corrugated iron. In fact, with the exception of the wood decks, there is practically no wood in the ships. The ships will be barque-rigged, with a bowsprit, and a much larger spread of canvas is intended to be fitted than in the *Iris*. This heavy rig will reduce the speed when steaming against a head wind, and will be altogether out of place in an action, but it is probably required for cruising and training purposes in time of peace.

Rhenania.—On the 30th Oct. Messrs. Dobie & Co. launched from the Govan shipbuilding-yard a steel screw steamer, of about 1,260 tons, classed 100 A 1 (steel) at Lloyd's, built to the order of Messrs. Wm. H. Muller & Co., of Dusseldorf and Rotterdam, for their mineral ore trade. The machinery is being supplied by Messrs. Muir and Houston, of the Harbour Engine-works, Portman-street, Kinning-park. As the vessel left the ways she was named the *Rhenania* by Miss Ross of Ravensleigh. Dowanhill.

Newcomen.—On October 31, Messrs. Robert Duncan & Co., Port Glasgow, launched this steel screw-steamer of the following dimensions:—290 by 38 by 26.6 2100 tons gross and 1350 register, capable of carrying 3400 tons deadweight of cargo. After the launch she was taken to Glasgow to be supplied with engines by Dunsmuir and Jackson, Govan. This vessel has been built to the order of Messrs. Leitch and Muir, Greenock, and her engines will be of 240 horse-power, a speed of 10 knots being expected.

Goya.—On the 1st Nov. there was launched from the shipbuilding yard of Messrs. W. B. Thompson & Co., of Dundee, an iron steamer named the *Goya*. Her dimensions are:—Length, 205 feet; breadth, 30 feet; depth 22 feet; and 1,008 tons gross. She has been built for a firm in Seville, and is to be engaged in trade between Spain and London. She will be supplied with engines of 90-horse power, and will be commanded by Captain Zaragoza.

Bellmore.—On Nov. 4 Messrs. H. M'Intyre & Co. launched from their shipbuilding-yard at Merksworth, Paisley, the *Bellmore*, an iron screw-steamer of 1,700 tons, built to the order of Messrs. Little & Co. Glasgow, for Messrs. Bell Brothers and M'Lellan, Glasgow, for general trade. The *Bellmore* is classed 100 A 1, and is designed for a good carrying boat, and is fitted with all the latest improvements, including patent steering gear, water ballast in double bottom, &c. The engines are being constructed by Messrs. Muir and Houston, Glasgow. The builders have almost ready for launching a sister ship to the *Bellmore*, which is intended, for Messrs. James Little & Co.'s own trade. The ceremony of naming was performed by Mrs. James Bell, of Glasgow, wife of one of the owners.

Teviotdale.—On the 8th of Nov., there was launched from the shipbuilding yard of Messrs. Alex. Stephens & Sons, Linthouse, Govan, an iron four-masted sailing ship of about 1,700 tons gross register, classed 100 A 1 at Lloyd's, with extras beyond their requirements. She has been built to the order of Messrs. J. and A. Roxburgh, of Glasgow. A cabin in the poop gives accommodation for the captain and officers, and a topgallant forecastle for the crew, with iron houses on deck for galley and apprentices; she is provided with Emerson, Walker, & Co. patent double purchase capstan windlass, all the most recent appliances for the efficient working of the ship and cargo. She was named the *Teviotdale* by Miss Angus, Helensburg, and will be commanded by Captain Duncan, late of the *Tweedsdale*.

Paramatta.—On November 11th Messrs. Caird & Co., Greenock, launched from their shipbuilding yard, for the P. and O. Steamship Company, a steamer of 4,800 tons gross, and of the following dimensions:—Length, 430 ft.; breadth, 43 ft.; and depth, 37 ft. As the steamer left the ways she was named the *Paramatta* by Miss Cowan, of Stoneleigh. With all modern improvements for the convenience and comfort of passengers, and the efficient and speedy loading and unloading of cargo, the steamer has been built to class 100 A, the highest class at Lloyd's. The hull of the vessel is constructed entirely of steel, and internally she is fitted up to accommodate 157 first-class and 48 second-class passengers. On the upper deck are six steam winches for working of cargo, all constructed by Messrs. James Steele & Co., of Birkenhead, a steam windlass by Harfield, and steam steering gear by Messrs. Muir & Caldwell, of Glasgow. For protection against fire, fire-pipes have been led into every compartment in the vessel, and are capable of being brought to bear upon any outbreak with great ease and speediness. The vessel will be supplied by the builders with compound surface-condensing engines of 4,000-horse power, and with these it is anticipated she will attain a speed of 14½ knots. Her cylinders will measure 56 in. and 100 in. in diameter, and will have a stroke of 5 ft. 6 in. Immediately after the launch the vessel was towed to the Victoria Harbour, where her engines will be put on board and her outfit completed.

West Lothian.—On November 11th Messrs. Charles Connell & Co. launched from their building yard at Scotstoun this four-masted iron sailing ship of 1,800 tons, built to the order of Mr. James Boyd, Helensburgh.

Ensign.—On November 11th there was launched from the yard of Messrs. T. B. Seath & Co., Rutherglen, this iron screw steamer, built to the order of Mr. J. R. Currie, Glasgow, and intended for general coasting trade. Her dimensions are as follows:—Length of keel, 145 ft.; breadth, 23 ft.; depth of hold, 10 ft. 6 in. Gross tonnange, 320 tons. Engines, compound surface, 50-horse power, nominal, supplied by Messrs. J. & T. Young, Ayr.

On November 11th Messrs. R. D. Ross launched from their patent slip and shipbuilding yard at Inverkeithing an iron twin screw steamer, built to the order of Messrs. W. G. Lochhead, Glasgow, and constructed under the supervision of Messrs Pile & Co., London, for a Spanish firm, for passenger and towing purposes.

Kirby Hall.—On November 11th the London and Glasgow Shipbuilding and Engineering Company launched from their yard at Govan an iron screw steamer, for the Hall Line (Messrs. Alexander, Ratcliffe & Co., Liverpool), trading between Liverpool and Bombay. The principal dimensions are:—Length, 330 ft.; breadth, 39 ft. 9 in.; and depth of hold, 26 ft. The vessel has a gross registered tonnage of 2,800, and has three decks. Classed 100 A 1 at Lloyd's, and built in conformity with Board of Trade requirements for the East Indian trade, she has been fitted up with all the newest appliances for facilitating despatch and safety at sea. Her engines, which are expected to develop a high rate of speed, are conducted on the compound surface-condensing principle, with cylinders of 36 in. and 70 in., giving a 48 in. stroke, and working up to a pressure of 80 lbs. The new ship left the ways in capital style, and was named the *Kirby Hall* by Mrs. D. T. Macleay.

Kilbrannan.—On November 11th, there was launched from Messrs. Russell & Co.'s shipbuilding yard, Port Glasgow, an iron sailing ship of about 1,600 tons register, and a dead weight carrying capacity of 2,600 tons. The dimensions are as follows:—Length between perpendiculars, 248 ft.; breadth, 38 ft.; and depth of hold, 22 ft. 9 in. The vessel which has been built to the order of Messrs. Kerr, Newton & Co., Glasgow, is fitted with Emerson, Walker & Co.'s patent double purchase capstan windlass, and all the latest improvements for the rapid loading and discharging of cargo. On leaving the ways she was named the *Kilbrannan*. We understand she will load either in Port Glasgow or Greenock for Rangoon.

Lauderdale.—On November 14th, there was launched from the shipbuilding yard of Mr. W. B. Thompson. Whiteinch, a steel screw steamer of the following dimensions:—Length, 265 ft.; breadth, 36 ft.; depth, 22½ ft.; gross tonnage, 1,790 tons; dead weight carrying capacity about 2,800 tons. She has been built to the highest class at Lloyd's, with complete cellular double bottom, and six watertight bulkheads, and will be fitted with engines and boilers of large power by Messrs. Rankin & Blackmore, Greenock. Bow, M'Lachlan & Co.'s steam steering gear has been fitted amidships, and Chadburn's patent telegraph has been adopted to communicate between bridge and engine room. On the forecastle a powerful steam windlass and with capstan (Emerson & Walker's patent), is provided for working the anchors, She has been built to the orders of Messrs. Robert MacKill & Co., steamship brokers, Glasgow, and will form an addition to that firm's Dale Line. As the vessel left the ways she was named the *Lauderdale* by Mrs. David Marshall, of Glasgow.

Golcondu.—On November 15th, Messrs. A. J. Inglis launched from their yard at Pointhouse the screw steamer *Golconda*, for the British India Steam Navigation Company. The dimensions of the *Golconda*, which is built of steel, are:—Length, 285 ft.; breadth, 36 ft.; depth 29 ft. 9 in.; tonnage, 2,100 tons. She will be fitted with engines of 1,200 indicated horse power, by the builders.

Fulda.—On the 15th November Messrs. John Elder & Co. launched from their shipbuilding yard at Fairfield, Govan, an iron screw steamer of 5,100 tons gross register for the North-German Lloyd of Bremen. This vessel, which is intended for the Bremen and New York Line, is of the following dimensions:—Length, 450 ft.; breadth, 46 ft.; depth, 36 ft. 6 in. She is classed the highest grade of the Bureau Veritas, with several extras over their requirements, such as iron lower and orlop decks, and additional watertight bulkheads. The upper deck is of teak. All the deck-houses and deck work, it may also be stated, are either of teak or iron. To protect the vessel from the heavy Atlantic seas, strongly constructed turtle-decks are placed at both ends of the ship. In the centre part of the upper deck there are houses for the officers, firemen, &c., together with galleys, smoking-room, entrances to first and second-class saloons, &c.; over this there is a promenade deck about 180 ft. long, and the whole width of the vessel, solely appropriated to the use of the first-class passengers. Besides this accommodation for the ship's officers and crew, 170 in number, the vessel will carry 170 first-class, 90 second-class, and 1,100 third-class passengers. The steerage passengers are berthed on the lower deck, while the first and second-class passengers are located on the main deck; the chief saloon being placed forward of the engines and boilers, as is generally the case in first-class vessels now-a-days. The vessel is rigged with four pole masts of iron, with yards on the fore and main masts. She is provided with steam windlass, steam and hand steering geer, steam winches, steam hold pumps, steam navy pumps, fresh-water condenser, and, in fact, all modern appliances to ensure the safety of the vessel at sea and to facilitate the working of cargo. The vessel will be propelled by compound engines of the inverted cylinder type, supplied by the builders, having two low-pressure cylinders, 86 in. diameter, and one high-pressure cylinder of 62 in. diameter, 5 ft. stroke, and working up to 95 lbs. pressure. Steam is supplied by four double-ended boilers, with six furnaces in each, and it is fully expected that the engines will develop 6,000 indicated horse power. This vessel is a sister ship to the *Werra* (s), launched in July by Messrs. John Elder & Co. for the same company. As the vessel left the ways she was named the *Fulda* by Miss Frances Duff, of Hillhead.

Polcevera.—On November 15th there was launched from the shipbuilding yard of Messrs. Blackwood & Gordon, Port Glasgow, an iron screw steamer of the following dimensions:—Length, 300 ft.; breadth of beam, 37 ft. 3 in.; depth of hold, 25 ft. 6 in.; gross tonnage, 2,250 tons; deadweight carrying capacity, 3,200 tons. This steamer has been built to the highest class in Lloyd's, having water ballast right fore and aft on the cellular principle, and is fitted with Emerson, Walker & Co.'s patent horizontal direct-acting windlass, steam winches, and steam cranes, Bow & M'Lachlan's steam-steering gear, and all the latest improvements. Accommodation for captain, officers, and engineers, will be fitted up in large house amidships, and for first-class passengers in poop aft She is also fitted up with accommodation for 500 emigrant passengers, and is furnished with special baths, wash-houses, bakeries, &c., for the comfort and convenience of passengers and crew. She is to be propelled by a pair of compound engines of 200 nominal horse power; diameter of cylinders, 35 in. and 67 in.; length of stroke, 42 in.; with two large tubular boilers capable of maintaining a constant working pressure of 80 lbs. per square inch, which have been constructed by her builders. This steamer has been built to the order of the Societa Italiana di Transporti, Marittimi, Raggio e Cia., of Genoa, and is the first of four sister steamers which Messrs. Blackwood & Gordon are building for the above-mentioned firm for their line of steamers hailing from Genoa. This steamer has been designed by and constructed under the surveillance of Commander Mattei, late of the Royal Italian Navy, ably assisted by Signor Migliardi. On leaving the ways she was named the *Polcevera* by Mrs. George Breen, of Partick.

Gogo Burn.—On November 16th, there was launched from the shipbuilding-yard of Messrs. Birrell, Stenhouse & Co., Dumbarton, an iron barque, of 1,000 tons register. She has been built under special survey to the highest class at Lloyd's, with all latest improvements, to the order of Morris Carswell, Esq., Glasgow, for the Burn Line. As she left the ways she was named *Gogo Burn* by Miss Carswell, Murchia House, Pollokshields. After completion she will take the berth for Sydney, as Messrs. Aitken, Lilburn, & Co.'s packet for December, under the command of Captain Macgowan, late of the *Ben Venue.*

Ardanrigh.—On November 14th, Messrs. Napier, Shanks & Bell, Yoker, launched an iron screw-steamer of about 1,400 tons and 120-horse power, built to the order of Messrs. Maclaren, Crum & Co., Glasgow. Her dimensions are 244 ft. by 34 ft. by 19 ft., highest class at Lloyds', with various extras beyond their requirements, and suited for carrying large deadweight cargoes on a light draught, with accommodation for a few first-class passengers. Water ballast in holds and peaks, steam winches and bridge steering gear, and Napier's screw gear aft. The vessel was named *Ardanrigh* by Miss King, of Rutherglen, and the machinery is being supplied by Mr. King's firm. The *Ardanrigh* is the seventh vessel belonging to Messrs. Maclaren, Crum & Co.'s firm.

Changchow.—On November 18th, Messrs. Scott & Co. launched from their yard at Greenock the last of six screw steamers, built to the order of Messrs. John Swire & Sons, of London. This vessel is named the *Changchow.* Her dimensions are as follow:—Length, 270 ft.; breadth, 35 ft.; depth, 26½ ft. She is constructed on the same lines as those previously launched. After the launch the vessel was towed to the East India Harbour, where her builders will supply her with the necessary fittings, and engines of 200-horse power. The *Changchow* will be employed in the China trade.

Clan Ogilvie.—The eighth steamer built by Messrs. Alexander Stephen & Sons for the well-known Clan Line of Messrs. Cayzer, Irvine & Co., of Linthouse, was launched from their shipbuilding-yard at Linthouse, Govan. on November 24th, and named the *Clan Ogilive* by Miss Cayzer, Milliken House, Renfrewshire. She is a very handsome vessel of about 2,600 tons, and has been built under special survey to class 100 A 1 three-deck rule in Lloyd's, with scantlings, however, considerably in excess of their requirements, while the extra number of bulkheads with which she has been provided permit of her being put upon the Admiralty list of ships suitable for transports. Her accommodation for passengers is very complete and elegant, and well designed for tropical voyages, the ventilation being a special feature throughout. She is fitted with provision for water ballast in double bottom on the cellular principle throughout, and her appliances for working ship and cargo are of the most approved and efficient kind. Her engines, also built by Messrs. Stephen, are of the most improved compound surface-condensing type, with cylinders 38 in. and 68 in. diameter by 45"in. stroke, and have ample boilers suitable for a working pressure of 85 lbs. The machinery and boilers having been all fitted complete on board (as is customary at Linthouse) before launching, the vessel is ready to receive cargo, and will sail for Bombay on thk 2nd prox.

S. S. Mereo.—On the 7th of November, there was launched from the shipbuilding yard at Flensburg, a new screw steamer, to the order of Messrs. H. Schuldt & Co., shipbrokers at Flensburg. Her dimensions are 212" by 29'8" by 15'0". She is a spar-decked vessel, with water ballast in double bottom, and she is built under special survey to Veritas, highest class, and will be fitted with compound engines of 85 nominal horse power, by the Flensburg Shipbuilding Co. The customary naming ceremony was performed by Miss Frida Böhmer."

ERRATUM.

Union.—In our October number we state, "A feature in her construction is that she will be supplied with two auxiliary screws—one on each side amidships—to be used when the ship is becalmed, the engines of which are to be supplied by Mr. A. M. Lelland, should read by Messrs. J. Scott, Sons & Watts, Glasgow.

LAUNCH.—SWEDISH.

Linnæus.—This screw steamer was recently launched from the yard of the Motala Mekaniska Verkstad, Sweden. Her dimensions are:—Length between perpendiculars, 250 ft.; width, 25 ft.; with a very shallow draught, The vessel, which is built entirely of Bessemer steel of Swedish manufacture, is intended for the transport of mineral oil in the hold on the Caspian Sea, for which purpose she is provided with steam pumps for the rapid discharge of the same. She is fitted with engines of 120-horse power, and her boilers are to be heated with astaka, an offal in the manufacture of naphtha. The owners are Messrs. Nobel Brothers, of St. Petersburg, who now possess more than a dozen similar vessels, employed in their extensive oil trade in South Russia.

TRIAL TRIPS.

Fayal.—On the 25th October, the steamer *Fayal*, built by Ross and Duncan, Whitefield Works, Govan, and intended for the towing service of the Portuguese Government, went on her trial trip. She is an iron screw steamer; 62 ft. between perpendiculars by 13 ft. by 7 ft. 6 in.; and has compound surface-condensing engines of 75-horse power, with direct-acting pumps and tubular boiler, 80 lbs. working pressure. She is fitted with one of Duncan's patent propellers, designed in this instance for special efficiency in towing. The speed attained was over 11 miles per hour with easy steam, and the very moderate piston speed of 400 ft. per minute.

Ballaarat.—On the 27th October, a satisfactory preliminary trial trip was made by the new Peninsular and Oriental Steamship Company's steamship *Ballaarat*, lately launched by Messrs. Caird and Co., Greenock. The dimensions of the *Ballaarat* are:—Length, 420 ft.; breadth of beam, 43 ft.; and depth of hold from spar deck, 37 ft. Her gross tonnage is 4,752 tons, and at a load draught of 24 ft.; she will carry 3,800 tons dead weight. The engines, which are of the usual compound type, are 900-horse power nominal, and indicate 4,000-horse power. The cylinders are of 56 and 100 in. diameter, with 5 ft. 6 in. stroke. The *Ballaarat* has four main boilers with 26 furnaces, and in the stoke-hole and engine room every provision has been made for the comfort and convenience of the officials. Accommodation has been provided for 157 first-class and 48 second-class passengers, the latter being accommodated on the main deck forward. On the spar deck are six winches for working the cargo, supplied by Messrs. Taylor & Co., Birkenhead. Patent windlasses, by Messrs. Harfield & Co., and steam stearing gear by Messrs. Muir and Caldwell, Glasgow, are also provided. At the measured mile two runs were made. The first was with wind and tide, and the speed of 16·143 knots was attained. On the run back against wind and tide the speed was 15·120, giving a mean rate of 15½ knots an hour. The trials were thus eminently satisfactory, the guaranteed speed being 14 knots.

Rennie.—On the 26th October, the screw-steamer *Rennie*, built by the Tyne Iron Shipbuilding Company, Willington Quay, to the order or Messrs. James Wait & partners, of North Shields, was taken to sea for her trial trip. The dimensions of the *Rennie*, are:—Length 250 ft.; breadth, 35 ft.; and depth of hold, 16 ft. The engines, by the Wallsend Slipway and Engineering Company, are 140-horse power, with cylinders 30 in. and 58 in. and 36 in. stroke. They worked well during the trial, and, notwithstanding that the steamer was fully laden, she attained an average speed of 9½ knots an hour. The vessel was built to carry a large cargo on a light draught of water, and with 1,850 tons of coals on board, she drew 15 ft. 7 in. aft and 14 ft. 7 in. forward. After the trial, the *Rennie* proceeded on her first voyage to Cork, commanded by Captain E. F. Adams, Howdon.

Loire Inferieure.—On October 31st the *Loire Inferieure*, built and engined by Messrs. Pearce Brothers, Dundee, made her trial trip to the Bell Rock. A numerous company of gentlemen were present. Luncheon was served at half-past one by Mr. Hume, of the Oriental, in first-class style. Mr. R. A. Pearce presided. After the toast of "The Queen" had been duly honoured, the Chairman proposed "The Health of the Owners, Messrs. Pile & Co., of London." He remarked that the whole transactions in connection with this and their first steamer had been characterised by extreme pleasantness, and, as a proof of this, he mentioned that they had contracted to their mutual satisfaction last week for the delivery of other two steamers at the ends of August and September next. He coupled the toast with the name of Mr. Albert Pile, the senior partner then present. Mr. Pile, in reply, said the two contracts which had been completed had been concluded to their entire satisfaction, and he had no doubt it would be the same with any future contracts his firm might entrust to the Messrs. Pearce. The Chairman subsequently, speaking in French, gave "The Health of the Compagnie Nantaise," to whom the Messrs. Pile had sold the ship, saying that from the moment he had made the acquaintance of M. Bonnefoy, the Managing Director of the Company, and of M. Coitre, the captain, he had had the greatest pleasure in meeting their views. In the absence of M. Bonnefoy, Captain Cloitre replied in French. Mr. Pile then proposed "The Health of the Builders," to which the Chairman suitably replied. Among the other toasts were "Messrs. H. E. Moss & Co., of Liverpool and London," "Messrs. Pearce's Managers," and "The Ladies," all of which were duly honoured. The vessel attained a speed of 11 knots per hour, the machinery working with great steadiness and to the entire satisfaction of the owners. A very pleasant day was spent, and Camperdown Dock was reached at 5.30. Among those present were Mr. Cohan, of Liverpool; Captain Strulese, of Genoa; Mr. Pile, Mr. Luke, Mr. Lee; Mr. Donovan, of Hull, &c., &c.

Dilsberg.—On November 1st the new screw steamer *Dilsberg* went down the Clyde on her official trial trip, and attained a speed of about 12 knots with ordinary working. She afterwards left for London, having been chartered by Messrs. Donald Currie & Co. to go to the Cape. She has been built by Messrs. Murdoch & Murray, Port Glasgow, and engined by Messrs. Kincaid, Donald & Co., Greenock, for Messrs. Raeburn and Verel, Glasgow, under the superintendence of Messrs. MacNicoll and Smith, Glasgow, and has Lloyd's highest class. Her carrying capacity is about 2,300 tons, and she has engines of about 180 horse power nominal. She is built on the three-deck rule, her upper deck being steel, with forecastle, bridge, flying-bridge, and cabin aft. She is fitted with water ballast in both holds, three steam winches, steam windlass, steam steering gear, lighthouses, &c.

Louise.—On November 2nd there proceeded to sea from the yard of her builders, Messrs. Raylton Dixon & Co., Middlesbrough, the steamship *Louise*, built to the order of Messrs. Burdick & Cook, of London. Her dimensions are:—Length, 270 ft.; breadth, 35 ft.; depth (moulded), 18 ft. 7 in.; and she will carry a cargo of about 2,000 tons on a draught of 16 ft. 6 in. She is built on the raised quarter-deck rule, having iron decks, long bridge, cabins placed aft, and is fitted with exceptionally large hatches and iron shifting-boards to accommodate her to the Board of Trade requirements for carrying grain: her winches also are exceptionally powerful for the purpose of lifting heavy machinery, and her donkey boiler is Cochran's patent; she has water ballast in both holds, and engine-room, pole masts. In her cabins aft is also accommodation for six passengers. Her engines of 150 horse power by Messrs. Blair & Co. (Limited), of Stockton, gave every satisfaction on trial trip, attaining a speed of 11 knots, after which she proceeded direct to Millwall Dock, London, where she loads for Constantinople.

We are pleased to notice that another large and powerful steam tug boat, built by Edward Finch & Co. (Limited), left the River Wye on Tuesday, October 24th, on her trial trip for Cardiff, where she arrived a few hours later in good working order. Her principal dimensions are:—Length, 85 ft.; breadth, 16 ft.; depth, 9 ft. 6 in.; and she is fitted with surface-condensing engines of 60 nominal horse-power.

S.S. Dublin.—On Nov. 16 this steamer of the Tedcastle line, trading between Dublin and Liverpool, proceeded down Belfast Lough on her trial trip, atter receiving new engines and boiler and undergoing extensive repairs. The *Dublin* has a carrying capacity of 750 tons. The engines and boiler, by the old and eminent firm or Victor Coates & Co. (Limited), Princes Dock, Belfast, are on the most improved principles, compound surface condensing dia of H.P cylinder 26 in., L.P. 45 in., stroke 30 in., with steam pressure of 80 lbs., worked smoothly at 77 revolutions per minute. The boiler of steel, 13 ft. 8 in. diameter by 10 ft. 6 in. long, has three furnaces 3 ft. 5 in. diameter, is constructed as to prevent almost any possibility of priming. It is fitted with Weir's patent hydrokineter for heating the water in the bottom of the boiler and causing circulation. The safety valves are Coe's patent. All the work in this department has been carried out by Messrs. Coates & Co. in the usual efficient and reliable manner. The boiler is intended to work at 80 lbs. pressure. Chadburn's engine room telegraph is fitted. All repairs in the shipbuilding department have been carried out by Messrs. Workman Clark & Co., Belfast. During the trip the company on board sat down to luncheon, Mr. Clark presiding. Amongst those present were Mr. Victor Coates, Mr. David Coates, Mr. Draper, the Company's Superintendent, Mr. Fielding, Board of Trade Surveyor, Mr. Orr, Lloyd's, Surveyor, Mr. J. Whitehead, Manager Princes Dock Works, Mr. J. Pollock, Superintendent Engineer Princes Dock Works, Mr. James Hind, Mr. Alex. Richardson, Mr. Dunlop, Lagan Foundry, Mr. Vernon, Princes Dock, Mr. Robert Beith, Consulting Engineer, &c., &c. A speed of over 10 knots an hour was obtained, which was considered satisfactory. Captain Redmond was in command.

The Ruby.—On the 2nd Nov. this new screw steamer, of about 220 tons burthen, built for the coasting trade for Messrs. Mitchell and Rae, of Newburgh, Aberdeen, went down the Clyde on her official trial trip, with a full cargo of coal on board, and attained a speed of 10 miles with ordinary working. Her engines, which are compound surface-condensing, of about 50-horse power nominal and very complete, are by Messrs. Tees, Anderson, & Co., Glasgow, the hull having been built by Messrs. John Fullerton & Co., Paisley. She has water ballast in double bottom in main and fore holds and in after-peak, two steam winches and separate donkey boiler, patent windlass, &c. The vessel and machinery have been constructed under the superintendence of Messrs. M'Nicoll and Smith, Glasgow, and to Lloyd's highest class.

Hye Leong.—This new iron screw steamer of about 550 tons, built by Messrs. Blackwood and Gordon, Port Glasgow, and fitted by them with compound-surface condensing engines of 110 horse-power nominal, went down the Clyde on her official trial on the 3rd Nov., and attained a speed of about 11¾ knots loaded. She has been constructed under the superintendence of Messrs. M'Nicoll and Smith, Glasgow, and is to Lloyd's highest class. She is intended for passenger and cargo service in the East, and will be commanded by Captain Lyon, of Singapore.

Shap Fell.—On the 20th Oct. the *Shap Fell* (s), lately launched from the yard of the Campbeltown Shipbuilding Company, and built for Messrs. Hume, Smith, & Co., Liverpool. went down the River Clyde on her trial trip. After having compasses adjusted at the Gareloch she proceeded to try her speed, which was ascertained to be 11 knots per hour. The machinery, which has been supplied by Messrs. Dunsmuir and Jackson, Govan, Glasgow, worked to the entire satisfaction of the owners and their superintending engineer, Mr. J. Carlton Stitt, of Liverpool. This vessel forms the fifth of the Fell Line, and, having large hatches, will form a valuable addition to the fleet.

The Henrietta.—There proceeded to sea on 10th Nov., from the yard of her builders, this paddle steamer, which has been built by Messrs. Raylton, Dixon & Co. for service in the Dutch colonies of the East Indies, and to the requirements of the Dutch Government. She is 97 ft. long, 19 ft. breadth of beam, 8 ft. 9 in. depth of hold; is laid with teak decks and bridge, and has teak fittings and rail, accommodation for officers aft, and crew forward, and is engined with 40-horse power condensing paddle engines, with disconnecting wheels, feathering floats, &c., by Messrs. Kincaid & Co., of Greenock. She has been built under the inspection of Captain Blacklin, of West Hartlepool, and will be commanded by

Captain M'Moutrie for her voyage out to Java. The speed attained on her trial trip was 10 knots, which was considered very satisfactory.

Ousel.—On the 10th Nov. the steamship *Ousel*, belonging to the Cork Steamship Company, went on her trial trip after being thoroughly overhauled and refitted with new decks, winches, cranes, steam steering gear, and a pair of surface condensing engines, with cylinders 26 in. and 49 in. diameter respectively, with a stroke of 30 in., and two steel boilers, having two furnaces in each, supplying steam at a working pressure of 80 lbs. per square inch. Her engines, which combine all the latest improvements, have been constructed by Messrs. David Rollo & Sons, of this city, who have had the entire work, which has been completed under the superintendence of Mr. F. C. Kelson, the company's engineer. The trial was in every way a success, everything working smoothly, and at 72 revolutions per minute the vessel attained a speed of over 10 knots per hour. Although the weather was very unfavourable, all on board expressed themselves highly satisfied with the results. The vessel is intended to take her station next week.

Constance.—On Nov. 21, the *Constance*, 14, unarmoured corvette, which has now left for the Pacific Station, made a measured mile trial of her engines, which are by John Penn & Sons, for the verification of the results obtained during the trial over the Maplin Sands. The draft of the ship was 16 ft. 9 in. forward, and 18 ft. 7 in. aft, the mean being slightly less than that at the former trial. Four runs were made under full power, and two runs each at two-thirds and one-third power. The following were the results:—

	Full Power.	Two-thirds Power.	One-third Power.
Steam in boiler......	64·3	64.12	64·25
Vacuum, forward ...	25·6	25·7	25·5
Do. aft.........	25·7	25·7	25·5
Revolutions	107	92	75
Mean pressures, high	34·11	26·17	16·32
Do. low	13·39	9·11	5·62
Total horse-power	2,518·2	1,559·5	797·75
Speed..................	13·71	12·07	9·94

Practically there was no difference between the two trials. The horse-power developed was about the same, while the difference in speed—that realized over the Maplin Sands being 13·787 knots—was a mere matter of decimals, and is more than accounted for by the condition of the hull. At both trials the power was greatly in excess of the contract. Captain Colomb, of the Portsmouth Steam Reserve, assumed command of the ship during the trial, the machinery being in charge of Mr. J. Ellis, Chief Inspector of Machinery, and Mr. R. J. Butler, of the Admiralty.

TRIAL TRIPS.—SWEDISH.

Dagmar.—This iron screw steamer, which was launched in September last from the yard of Mr. Emil Abrahamson, near Gothenburg, went on her trial trip recently. Her dimensions are:—Length between perpendiculars, 145 ft.; width, 24 ft.; depth in the hold, 11 ft.; and she draws, with a cargo of 500 tons deadweight, 11 ft. of water. She is rigged as a three-masted schooner, and fitted with engines, by the Lindholmen Mekaniska Verkstad, of 60-horse power nominal, and built to the order of a Gothenburg steamship company for the Baltic trade. The average speed obtained was 9 knots per hour.

Balder.—This screw steamer, launched from the yard of the Lindholmen Mekaniska Verkstad at Gothenburg in October, went ou her trial trip recently. Her dimensions are:—Length over all, 169 ft.; width, 23¾ ft.; depth in the hold, 11¾ ft.; while she draws, with a cargo of 570 tons, 16 ft. of water. She is built of Bessemer steel made at Motala Verkstad, and fitted with engines of 70-horse power which at her trial brought her up to a speed of 9¼ knots per hour, the rate contracted for being 8½ knots. The vessel is intended for the general carrying trade, and built for Mr. J. C. Gjertsenf, of Bergen.

Kristianstad.—This screw steamer, launched from the yard of Ljungren's Mekaniska Verkstad at Kristianstad in October, went on her trial trip recently. Her dimensions are:—Length between perpendiculars, 80 ft.; width, 16 ft.; depth of hold, 5 ft., and she carries a cargo of 100 tons deadweight. Her engines, which are compound, and of 10-horse power each, propelled her on her trial tip at the average speed of 8½ knots the hour, which was considered satisfactory. She has been built for the general carrying trade to the order of Kristianstad ängbätsaktiebolog of Kristianstad.

Bygdo.—On October 30th this vessel, built and engined by Kockum's Mekaniska Verkslads Aklie Bolag Malmo for the Christiania Dampskibs-Selskab, of Christiania, Norway, was successfully tried on the 12 knot course in the Sound. The ship measures 225 ft. by 31 ft. by 23 ft.; spar decked and classed 100 A 1 at Lloyd's; intended for general cargo trade, and fitted with every convenience for doing duty either in Europe or in the East. The machinery is of the usual inverted double acting type, cylinders 28 and 48, stroke 30 in. With a total weight on board of 400 tons the speed was 10 knots; indicated horse-power, 507; consumption 946 Norwegian pounds per hour.

TRIAL TRIP.—GERMAN.

Nerissa.—On October 26th the s.s. *Nerissa*, built and engined by the Flensburg Shipbuilding Company, to the order of Mr. A. Kirsten, in Hamburg, run her trial trip in the bay. This is the fourth ship built on this yard for Mr. A. Kirsten, and is of the following dimensions:—200 ft. by 30 ft. by 16 ft. 7 in., with a nominal horse-power of 100. She is intended to run between Hamburg and London, with passengers and piece-goods. She is fitted with an elegant cabin aft for first-class passengers, and 120 berths for second and third-class, under poop deck and in forecastle, has four strong steam cranes, winch, and steam windlass. On the trial everything worked to the entire satisfaction of the owner. She obtained a speed of 10¾ knots per hour, and a consumption of 9 tons of coal.

SHIPS BUILDING.

At Messrs. Palmer's shipbuilding-yard work as usual is going forward as briskly as a large number of workmen can make it in the different departments of the shipbuilding trade of the above firm. There are no less than eight steamers on the stocks in different stages of construction. Several are vessels of no mean dimensions. Two screw steamers are alongside the engine works receiving their engines and boilers, and two others are at the low end of the yard being rigged and fitted. There is also a steamer in the dry dock, and a steamer on the slipway. Messrs. Hepple's dock at North Shields is full of work, and they have just received an order for a large tug for Constantinople owners, to have surface condensing engines; and keels are laid at the dock for two new tugs. At Messrs. T. and W. Smith's, three new vessels are now being constructed. The whole of the shipbuilding-yards on both sides of the Tyne continue to be full of work, and excellent employment for the men, the only exception is that of the yard at Hebburn, where five berths are unoccupied. There are now 59 vessels under construction in the Wear shipyards. The marine engine works at Sunderland continue to be in full work, as well as the iron works and rolling works in the districts.

The *Novoe Vremya* states that the Russian Admiralty propose to build several vessels of the type of the English cruiser *Leander* and others; the whole of the body to be of steel, with a length of 300 ft., a width of 46 ft., and a tonnage of 3,748.

The Russian Navy.—For some time past, says the *Times* correspondent at St. Petersburg, the Russian Admiralty has been considering a project for increasing the fleet of the Baltic by the addition principally of light cruisers; and for constructing a strong ironclad fleet in the Black Sea. The following programme for 1883 has now been drawn up:—In all nine war vessels are to be built, seven for the Baltic and two for the Black Sea. For the Baltic are to be built two ironclads at the Baltic works, estimated to cost 2,800,000 roubles; one cruiser at the Nevsky works, to cost about 400,000 roubles; two cruisers at the Baltic and Nevsky works, to cost 800,000 roubles; and two gunboats at other yards in St. Petersburg, to cost 415,000 roubles. For the Black Sea two ironclads are to be built, one at Sebastopol, by the Russian Society of Navigation and Commerce, and the other at Nicolievsk, at a very heavy cost, the total for all the nine vessels being 7,469,643 roubles. The real cost will, of course, far exceed this sum. Measures are also on foot for considerably strengthening the forts at Cronstadt, in consequence of the lesson taught by the English bombardment of Alexandria; and a well-known military engineer is now being consulted on the subject.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from October 20th to November 20th.

4996 F. Yates (communicated to T. D. Clare). Compound armour plates.
5011 J. Dunbar. Slide valves.
5037 J. D. Cumnver (communicated to W. P. Thompson). Governors.
5058 G. G. Page & R. Nunn. Bathing and promenade piers.
5074 W. M. Walters. Manœuvring and steering vessels.
5089 A. Watkins. Man and mud-holes in steam boilers.
5090 R. Rose. Preserving ships, lives, and property at sea.
5101 F. S. Greenaway & A. Kitt. Rotary engines.
5102 T. H. Ward. Cables.
5168 Stollwerck Bros. (communicated to S. P. Wilding). Steam boilers.
5210 R. B. N. H. J. Duncan. Lowering and launching ship's boats and saving life at sea.
5211 G. Read. Trawl nets.
5212 W. Tate. Screw propellers.
5218 H. Martin & F. Segondy (communicated to J. Y. Johnson). Propelling boats, &c.
5223 M. Bourke. Lowering, raising, and detaching ship's boats.
5268 J. Rebecca. Screw shaft thrust blocks.
5270 W. A. Rettig (communicated to A. J. Boult). Rowing boats.
5276 A de Souza (communicated to W. R. Lake). Utilizing motive force of waves, chiefly to produce electrical energy.
5278 S. Trott & F. A. Hamilton (communicated to G. E. Vaughan). Telegraph cables.
5282 J. McFarlane. Compound marine steam engines.
5290 C. & H. Zacharias (communicated to F. J. Cheesbrough). Smoke consumer.
5293 J. N. Mocrath. River and canal locks, and obtaining motive power.
5313 A. Guhraner & R. C. Wagner (communicated to C. D. Abel). Steam supply regulator.
5327 F. Gill. Valves.
5384 F. E. Canda (communicated to A. M. Clarke). Bearings.
5385 P. Orolli (communicated to A. M. Clarke). Raising sunken vessels.
5389 S. S. Sugden. Suspending. hoisting, lowering and disconnecting heavy weights, &c.
5397 C. Nelson. Injectors.
5402 W. Allan. Steam winches.
5410 J. Duncan. Steam steering apparatus.
5423 W. Pepper. Steering, &c.
5456 A. Pratt. Hammocks.
5459 W. J. Mackenzie. Sounding appliances.
5476 R. T. Pawley. Hatches.
5484 J. & T. Kirkaldy. Anti-fouling ships' bottoms.
5501 G. M. Key & J. Lowrie. Self-acting skeps for grain cargoes, &c.
5511 S. A. L. Klixbull (communicated to F. Wolff). Saving life at sea.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

October 28th, 1882.

Allan, John M.	1 C	Glasgow.
Anderson, Jno. M.	1 C	London.
Anderson, M. H.	1 C	Glasgow.
Brighton, John	2 C	do.
Cameron, Dncn.	2 C	do.
Clerk, Sir George Douglas, Bart. Master of his own yacht ...		London.
Craig, William	2 C	Lvrpool.
Crumble, Edward	1 C	N Shlds.
Cumming, Wm.	2 C	Glasgow.
Cuthill, Alex.	2 C	London.
Davison, Walter	2 C	N Shlds.
Deas, James ...	2 C	Glasgow.
Doust, Richard	2 C	London.
Gordon, Andrew	2 C	Glasgow.
Gough, Henry ...	2 C	Lvrpool.
Gray, Thomas ...	2 C	Glasgow.
Greenhill, George	1 C	do.
Grieve, James A.	2 C	London.
Harvie, John ...	2 C	Glasgow.
Hastie, John ...	2 C	London.
Inglis. Alex. S.	1 C	Aberdn.
Inmount, Colin	1 C	Glasgow.
Leitch, George T.	1 C	do.
Macfarlane, Jno.	2 C	do.
McMillan, Alex.	1 C	do.
Muir, Andrew ...	1 C	do.
Orr, Thomas ...	1 C	Lvrpool.
Paterson, James	1 C	Glasgow
Robb, William ...	2 C	do.
Ross, David ...	1 C	Belfast.
Scott, Robert ...	2 C	London
Sibley, Thos. M.	2 C	Sthmptn
Smart, Alex.	2 C	Glasgow
Stanley, George...	1 C	Lvrpool.
Stewart Alex. ...	2 C	London
Telfer John ...	2 C	Glasgow
Trewick, John E.	2 C	N Shlds
Wallace, Thomas	2 C	Belfast
Washer, John ...	1 C	Sthmptn

November 4th, 1882.

Anderson, R. G.	2 C	London.
Batchen, John M.	1 C	Glasgow.
Bradley, Thomas	2 C	London.
Crew, John B....	2 C	do.
Davis, Edwd. N.	1 C	do.
Duncan, James...	2 C	Lvrpool.
Ewing, James ...	2 C	London.
Gladstone, John	2 C	N Shlds.
Greenaway, Wm.	2 C	London.
Hollingsworth, W.	1 C	Sndrlnd.
Hume, Thomas	2 C	do.
Laiclaw, James	2 C	do.
Lewis, Hugh ...	1 C	Lvrpool.
Lochhead, Robert	1 C	do.
Merry, James...	2 C	Bristol.
Morris, W. A. ...	1 C	London.
Morrison, Wm.	1 C	Lvrpool.
Ratcliff, Arthur P.	2 C	London.
Richardson, Wm.	1 C	N Shlds.
Rutherford, R. C.	1 C	do.
Shaw, William ...	2 C	London.
Simpson, H. S....	1 C	Sndrlnd.
Smith, John H.	1 C	Lvrpool.
Thompson, F. H.	1 C	N Shlds.

November 11th, 1882.

Appleton, Jas. J.	1 C	N Shlds.
Bannerman, A. ...	1 C	Grnock.
Cable, William	2 C	London
Charleson, C. ...	2 C	N Shlds.
Davis, John B. ...	2 C	do.
Feggetter, Thos.	2 C	Leith.
Fitzgerald, C. D.	2 C	Hull.
Gibson, John ...	1 C	Leith.
Hague, James ...	2 C	London
Hood, James ...	2 C	Leith.
Jackson, Tom ...	2 C	Hull.
James, J. F. ...	2 C	London.
Johnson, Henry	1 C	do.
Leslie, Wm. ...	2 C	do.
Little, John ...	1 C	Leith.
Mace, Geo. D.	2 C	London.
McGlashan, J.	1 C	Glasgow.
McIntire, L. ...	2 C	N Shlds.
McKay, Wm. E.	1 C	Lvrpool.
Millar, David ...	1 C	Leith.
Palmer, James	2 C	Hull.
Roberts, H. ...	2 C	do.
Ryan, James ...	2 C	N Shlds.
Smith, S.	1 C	London.
Tod, David ...	1 C	Leith.
Wallace, Gavin	2 C	do.
Waller, Alex. W.	1 C	do.
White, Thomas	1 C	Lvrpool.
Wright, Thomas	2 C	do.

November 18th, 1882.

Begg, Edward	2 C	N Shlds.
Cole, Joseph ...	1 C	Lvrpool.
Crawhall, J. ...	2 C	N Shlds.
Harris, G. A.	2 C	Lvrpool.
Hills, W. G. ...	2 C	do.
Jones, H.	2 C	do.
Marns, A. ...	1 C	N Shlds.
Nisbet, James	1 C	London.
Pars, George	2 C	N Shlds.
Sharp, Thos. H.	2 C	W.Htpl.
Stokoe, John G.	2 C	do.
Voigt, Carl A.	1 C	N Shlds.
Wishart, Wm.	1 C	Glasgow.

IRON SAILING SHIPBUILDING.—When the Suez Canal was opened 13 years ago it was predicted that no more sailing ship tonnage would be built, as it was thought that there was then more than enough afloat for the services of the few trades that would be left it, and that the cargo steamship with the new coal economizing compound engines would more speedily and cheaply transport the products of the east and west from one to the other by the new and short route. In consequence of this opinion prevailing throughout the shipping world, many interested in sailing ships hurried out of this kind of property to invest in steam vessels, and the value of iron ships became lower than ever had been known. In less than three years after it was discovered the day of the iron sailing ship was not over, and the shipyards of the country were busy building iron ships of 1,500 to 1,700 tons register, at prices that reached as high as £20 to £22 per ton, or three times the price at which ships of the highest class changed hands in 1870. During the period of general depression of trade, 1877 to 1880, few iron sailing ships were built, but on the revival of the freight market two years ago, many orders for new ships were placed, and at present a large number of iron sailing ships are under construction, a great part of which are of tonnage that a few years since was considered too large to be conveniently worked under canvas, and for single firms to charter for cargo on account of their large capacity. When the American commercial marine was in existence it contained a greater proportion of very large ships than belonged to this country, and the iron ships we now are building for the Eastern and San Francisco trades are not much larger than those built by the shipowners of New York and Boston previous to the destruction of their commercial navy. The British shipowner has cautiously advanced the size of his ship for the great trades from 1,000 tons 20 years ago to 1,200 tons in 1868, 1,600 tons in 1875, and now the favourite ship has a register of 2,100 tons. A magnificent ship of this size, having a displacement of 4,800 tons, was launched on Nov. 28th from the dockyard of Messrs. Archibald M'Millan & Son, at Dumbarton, and named the *Imberhorne*. A beautiful model of this ship and her sister, the *Falconhurst*, now building in the same yard, was shown at the late International Exhibition of ship models, held in the Fishmongers' Hall. under the auspices of the Shipwrights' Company, and gained by Messrs. M'Millan for the second time the gold medal of the guild. The *Imberhorne* and *Falconhurst* are to form additions to the fleet of Messrs. W. R. Price & Co., of Lloyds, London.

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

ADVERTISEMENTS.

All Advertisements and Business communications must be addressed to the PUBLISHER, 3, Amen Corner, Paternoster Row, London, E.C., to whom all complaints respecting irregularities in delivery should be addressed. Advertisements must be sent in not later than the 25th of each month to ensure insertion in the following number.

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SUBSCRIPTIONS.

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The Marine Engineer.

LONDON, JANUARY 1, 1883.

EDITORIAL NOTES.

IT appears that there is an imaginary Naval force, in the shape of an Indian Navy, that holds a distinct and somewhat anomalous position of its own. Being placed entirely under the Indian Government, it is as distinct from the British Navy as the Indian Native Army is from that of Great Britain. This Indian Navy seems to consist, however, of only two monitors, which are already eleven years old, and to which, since the time of its first inception, eleven or twelve years ago, no further vessels have been added. This is surely an absurd condition of affairs. If India is to rely upon her own peculiar Navy for coast defence, which is evidently the *raison d'etre* of the force at all, then it is surely reasonable that the force should be adequate for such defence, and not be absurd in its weakness. We hear, however, that this is not the most serious reason for action in the matter. It seems that the position of this Navy is so anomalous, that "no legal means exist of enforcing discipline—a state of things which certainly cannot conduce to efficiency." An application is now being made to Lord Hartington, by the Indian Government, to place things on a proper footing. In former times the Indian Navy performed very valuable services, and was in an excellent state of efficiency and discipline. This old service passed away with the Old East India Company, and its successor is evidently as yet a degenerate descendant. We would suggest, however, that as a Navy is essentially a mobile force, the empire and colonies at large, India included, would be best benefited by a concentration of resources to maintain the most efficient Imperial Navy possible. We should imagine that just now would prove an eminently suitable time to effect such an arrangement. The whole British nation must have been delighted with the late successful proofs that our Navy is still our most brilliant weapon of offence and defence, and that all our Colonies might well aid in supporting such an effective and necessary guard to our world-wide maritime commerce.

THERE is apparently a large and extended market for American flat river steamers on the shallow navigable rivers of Europe and Asia. In China, they have already effected almost a revolution in the water-carrying trade of that empire, and we hear that there is a brisk demand for them already on the Volga. The plan adopted in that case by the American builders is to take out the machinery with them, and to build the steamers of timber on the spot. This plan produces a steamer much cheaper than the iron river steamers exported from England, which have been in use there for some time. Not only is their success due to that cause, but more especially owing to the fact that the American-built boats only require a draught of 4 feet, whilst most of the English steamers require nine. Even a draught of 5 feet bars the navigation through a great portion of the river, and the speed of the wooden American boats is said to be better than that of any of their iron competitors. The light draught of the American boats has opened up a navigable length of some 2,000 to 2,300 miles on the Volga, which will probably induce considerable further orders for the other large rivers of Russia. There should be an equally good market for such steamers on the rivers of the Argentine Republic, which are very wide but for the most part shallow. We understand, however, that there is a strong prejudice against them, owing to their liability to catch fire—the first two which were run on the Plate having been destroyed by fire. We do not see why America should have a monopoly of such flat-bottomed river steamers, and we recommend this to the attention of English ship-builders, though as a nation we are said to be the last to suit our goods to our customer's requirements.

Some few weeks ago one of the illustrated pictorial papers gave a startling illustration of a sea-going vessel mounted on floating propellers, the invention of a Mr. Fryer, which has been exhibited in a model form, twenty feet long, on the Harlem River, in the upper part of New York city. As an idea this is no new thought, that vessels may be made to roll over the surface of the water rather than push through it. We had occasion to discuss the idea as the invention of a Frenchman some years back, but nothing practically seems to have come of it. The picture of an imaginary vessel to which we refer, representing the superstructure of a two or three thousand ton Atlantic liner, carried on three drum propellers—say 20 to 30 feet in diameter by 10 or 15 feet wide, and immersed about 5 feet deep, is so imaginary as to be absurd. It seems to be forgotten by the enthusiastic admirers of this invention, that all floating bodies must displace a weight of water equal to their own weight. When this fact is realised and its consequence, that the submerged volume of any system of rollers must still be equal to the submerged volume of the hull of an ordinary vessel, the problem will not look so promising. That rolling friction on the surface of a fluid may be less than sliding friction upon it is quite possible, if not probable; but when the rolling body becomes half submerged, then we think that there is probably very little between them. The great use to which the small resistance of a rolling friction upon the surface of water for light weights, may be seen in the Rolling Ball Messengers now used at sea, and which travel enormous distances in marvellously quick time.

The world moves on at a startingly rapid pace from invention to invention, from one industrial revolution to another, leaving all behind in marvellous obscurity and forgetfulness. Who would think that it is only eighty years ago since the first pioneer of ocean steam navigation, the *Comet*, led the way to our present mighty ocean steamship companies; and it is already forgotten. How many of our marine engineers, seamen, or shipowners, know nothing of the *Comet*, or of its constructor, Bell, save, perhaps, in his native town of Helensburgh, where there is a granite obelisk to his memory. So little, however, are the facts concerning himself or his wonderful vessel, authentically preserved, that we see from the Scotch papers that it is a matter of open discussion as to when the wreck of the *Comet* occurred, and also as to the correct date of Henry Bell's death. It certainly seems that the world now travels so fast that we have no time to register dates as they pass *sic transit gloria mundi.*

We hear a very good account of a floating elevator, the invention of a Mr. James Rigg, of Chester. The arrangement is devised to effect the rapid mechanical coaling, somewhat after Messrs. Cory's fashion, and in foreign and American ports the apparatus may be used for loading with grain from barges and lighters. The chief novelty of Mr. Rigg's invention lies in the fact that his elevator mounted on a pontoon of comparatively small dimensions is so portable and handy. The elevator-creepers are two in number, and arranged in a massive lattice-girder pivoted on a central standard, carried on the deck of the pontoon. When the apparatus is in operation, the elevator-pontoon is moored alongside the vessel with, say, the coaling-barges outside her. The elevator-girder is placed athwart the pontoon, one end depressed, taking up the coal from the barge, and the other delivering it above the level of the deck of the vessel. It can thence be run down by suitable shoots to the coaling-doors in the side-bunkers simultaneously to both sides of the vessel. This is a great precaution against irregularity of stowage. When the elevator is not in use it can be stowed fore and aft of the pontoon, so as to make it stable and convenient for navigation from point to point. Owing to the pivoted attachment of the elevator it can be swivelled about in any direction, and raised to any required angle. All the operations and movements are effected automatically by steam-power.

THE VENTILATION OF SHIPS.—No. 4.

THE result of Richter's critical investigations respecting the weathering of coal is very valuable. He shows in these experiments the power of coal for absorbing atmospheric oxygen, and that this varies in different coal, that the absorption soon begins and progress very quickly, and is accelerated by heat.

To a greater or less extent all coal contains water or moisture when brought to the surface, and a part of this is lost when exposed to the air. The power also of coal to absorb and retain moisture varies in different kinds of this fuel, and which does not alone depend upon its structure. He also pointed out that a relation existed between the absorbent power of coal for water and oxygen, so that the more of the former it could take the greater is its absorbent power for the latter. Professor Ferguson, of Glasgow University, states that conclusions from Richter's experiments should not at once be accepted as a solution of the action of spontaneous combustion of coal cargoes, and while Mr. Rowan does not attempt to under estimate the importance of Richter's or other investigations of the like kind, "or to divert the direct bearing they may have of the action of the spontaneous ignition of coal on board ship, nor * * * demonstrate that when ignition has occurred, it has not been attributable in many instances to other causes than the oxidation of iron pyrites," but what he asserted was that from the facts disclosed in the report of the Royal Commissioners, the testimony shows "that in the majority of cases, chemical action has been set up by the oxidation of the iron pyrites in the coal." We also learn from this report and by experience that spontaneous combustion has not been confined to any one class of coal, but has occurred in nearly all kinds. Mr. Cooper Randell states in his evidence to the Commissioners that "the fires have not been confined to one kind of coal, but have occurred in most if not all the different varieties usually exported. In fact, the inquiries which have been made, support the opinion that no kind of ordinary coal containing hydrogen has immunity from spontaneous combustion * * * We find that the fires occur in the cargoes, whether the coal be loaded in summer or winter, by tip or by basket."

Wet or damp coal appears to have been the chief cause of spontaneous ignition on board ships when iron pyrites have been present in the coal, as moisture greatly promotes the oxidation of pyrites, although it is unfavourable to carbonaceous oxidation, as the dampness causes the carbon pores to be filled, and therefore proportionately reduces their power for the reception of oxygen.

In their report, the Royal Commissioners state that while certain kinds of coal are doubtless of such a quality as to be entirely unsafe for shipment, and other kinds should only under great precaution be shipped for short voyages, "it would, however, be of course impossible for us to cite with completeness or accuracy the various coals to be avoided, or their relative susceptibilities to spontaneous heating. The difficulties are two fold, first, because coals of very different character in this respect are produced from the same colliery, and secondly, because the conditions of shipment may be totally dissimilar. Nor can chemical analysis be relied upon in every case to furnish conclusive evidence as to the tendency to ignition." In many cases, spontaneous combustion of coal in ships has been occasioned, probably by the accumulation of small and crushed coal under the hatchways from the breakage of coal by the system of tipping it. Captain Cawkitt, the Manager of the Liverpool Salvage Association, said in his evidence to the Commissioners that "most of the burnings in the ships we have heard of have been under the main hatch, and the bulk of the burnings have been in vessels that have been loaded under the tips where the coal is broken, and where there has been a lot of small coal accumulating round the main hatchway, and I believe in most instances the fire has been proved to have originated about the main hatchway." The evil of this accumulation of small coal is also insisted on by many witnesses before the Commissioners. Mr. Scott, of the firm of Gillespy & Scott, large coal shippers for the British Navy, mentioned in his testimony the following important extract from a letter written by the master of the *Pocahontas*, lost by spontaneous combustion of coals in 1874. "Four Boston ships have been burnt this season within two months of each other, and the accounts given are about alike as to the cause of the fire. In most every case ships have taken fire in the hatchways where the fine coal is. If ships could be loaded so as to avoid the fine coals collecting in the hatchways, and some means taken to prevent the coals breaking up, I do not think fire would occur." The Royal Commissioners recommend that. "the breakage of coal in its transport from the pit to the ship's hold, the shipment of pyretic coal in a wet condition, and especially ventilation through the body of coal cargoes conduce to spontaneous combustion, even though the coal may not be unfit for conveyance on long voyages. That when coal is being carried on long voyages the temperature in the various portions of the cargo should be tested periodically by thermometer and registered in the log." Several witnesses have stated that spontaneous combustion has been seen to commence at all parts of the cargo from the kelson to near the surface. Upon this subject we agree with Mr. Rowan, who properly states that he thought it was clear after a careful examination and comparison of cases of spontaneous ignition of coal cargoes mentioned in the Commissioners' Report, that in most cases combustion has begun "by the oxidation of the iron pyrites commencing at some particular though capricious spot; that the heat so generated has gradually accumulated and accelerated the oxidation, and that sufficient heat has been transmitted to start (it may be) carbonaceous oxidation as well, and in the confined condition of the coal holds where this has been taking place, the heat so produced has likewise determined in parts of the cargo, the destructive distillation of the coal evolving thus products of a highly inflammable and explosive nature." We also learn from the Appendix to the Commissioners' Report, that the heating action of the coal just described has frequently caused the coal to suddenly burst out with flames all over, a result which has often been preceded by explosion, and occasionally followed by several explosions even when all the hatches have been blown off. The long and special scientific description by Dr. Percy and Professor Abel, of the causes of spontaneous combustion of coal in ships, enter more minutely into the details of this subject than have been given, but they agree substantially with the essential statements upon it by Mr. Rowan, which appears to be based upon their observations.

Another very important danger which arises from coal cargoes in ships is from the explosions from coal gas, known as fire damp, marsh gas, methyl hydride, carburetted hydrogen, &c.

It appears from Watts Dictionary of Chemistry, that equal volumes of marsh gas and chlorine will explode even if exposed for sometime to sun light, while if there is moisture this gas is converted into hydrochloric acid, carbonic acid, and carbonic oxide.

We are told that marsh gas, which arises from coal cargoes, only becomes explosive when mixed with certain portions of air, and before an explosion can take place, the application of a high red heat is required. Now according to Bloxhams' Chemistry, the supposed force exerted by the explosion of a mixture of one volume of marsh gas with two volumes of pure oxygen which occasions the most violent explosion, is equal to 555 lbs. on the square inch, and it has been ascertained that as the atmosphere only contains 20 per cent., or one-fifth of its volume of oxygen, it requires to attain its greatest explosive force ten volumes of air to one volume of marsh gas, and then it is much diminished by the dilution of the oxygen with eight volumes, which is a great proportion of inert nitrogen mixed with it. It is also calculated that the power of an explosion of one volume of marsh gas with ten volumes of air, is as much as 210 lbs. on the square inch, and when the proportion is as low as eighteen volumes of air to one volume of marsh gas, the mixture instead of exploding, will burn quietly, and when the proportion of marsh gas is more than one volume to ten volumes of air, the explosive force is also diminished, and with only one volume of marsh gas to five volumes of air, the mixture will not explode, but will extinguish a lighted candle placed in it.

The danger of explosion is much greater from some kinds of coal in ships' bunkers and holds than in others. Thus in the report of the inquiry by the Board of Trade respecting the explosion from coal gas, on board the screw steamship *Caduceous*, of London, in June, 1878, it is stated that semi-anthracite coal is known to be of an extremely explosive nature, and the colliery owners, from whence it is obtained, issue notices to shipmasters cautioning them of this fact, and advising them to keep their hatches open for several days after the coal is loaded, and that no flame should be allowed in the hold or any other part of the ship where the gas might collect. A bye-law to the same effect has been notified by the Penarth Dock Company.

The marsh gas is disengaged from the pores or cells of the coal when the surfaces are cut or broken, and in some cases this gas emanates from the coal in large quantities immediately after it is brought to the surface, and the escape of coal gas has been proved to be the greatest when first placed on board ship, and explosions in the holds of such whilst loading, on account of the gas being freed from the cells, in which it was secured by the breakage of the coal in its fall into the hold, by coming into contact with a naked flame. The Royal Commissioners arrived at the conclusion that "with the view to guard against explosion, free and continuous egress to the open air, independently of the hatchways, should be provided for the explosive gases by means of a system of surface ventilation, which would be effective in all circumstances of weather."

Now it is much to be deplored that these recommendations have been grievously neglected, in consequence of which several explosions from coal gas have occurred, from cargoes of this fuel in ships, whereby numerous lives have been lost, and an immense amount of property destroyed. It appears from the statistics of the Assistant Secretary, Marine Department of the Board of Trade, notified in his memorandum that the number of cases of explosion, tabulated by him for the five years preceding and including 1875, were 25, or an average of 0·053 to each 250,000 tons of coal carried, while during the five subsequent years, the explosion cases amounted to 46, being an average of 0·085 to each 250,000 tons of coal, or an increase of more than 62 per cent. on the total amount of coal carried.

On account of this blameworthy increase of explosions, which could have been avoided if due and simple precautions had been adopted by surface ventilation, the Board of Trade issued an official notice in July, 1881, in which the attention of shipowners, shipmasters, colliery owners, coal brokers, underwriters, and others, were directed to the conclusions of the Royal Commissioners, which we have quoted, to guard against these explosions, and which, according to recent investigations, appeared to be "either insufficiently known to or disregarded by the persons chiefly interested in the safe carriage of coal by sea." Certified shipmasters and officers are particularly cautioned that if they neglect to use due precautions to prevent explosions from coal in ships, this omission will be notified to the Wreck Commissioner, or to the Court which investigates the case.

The Board of Trade have given further notice that "as vessels laden with coal insufficiently or improperly ventilated are dangerous to human life, it is their intention under the Acts 17 and 18, Vict. c., 104, s. 239, and 39 and 40 Vict. c., 80, s. 4, or any other Acts enabling them so to do, to prosecute those persons who in future send or take, or attempt to send or take, or are parties to sending or taking, or attempting to send or take to sea, British coal-laden ships, which on account of such insufficient or improper ventilation, are in such unseaworthy state, that the life of any person is likely to be thereby endangered, and all persons who so neglect their duty in respect of ventilation as to cause danger to life or limb."

We quite agree with the statement of the Government Inspector of Mines for South Wales, in reference to the foundering of the screw steamer *Richmond* off Cape Finisterre, on account of an explosion of coal gas, that "without ventilation, the hold of a ship laden with coal is simply a great gas holder, and in the presence of a large body of high inflammable gas, pent up in an air-tight space, may expose the lives of the persons on board and the ship to destruction."

Some very important observations have recently been published in a recent number of the *Shipping and Mercantile Gazette*, upon explosions, ventilation, and trimming coal cargoes. The writer states that he has been engaged for the last fifteen years superintending the loading and inspecting coal cargoes in Cardiff, and has been entirely engaged for the last seven years in loading and inspecting cargoes of coal in steamers, from 3,000 down to 500 tons burden day and night in all weathers. He is of opinion that all ships can and ought to be well ventilated so that the hatches can if necessary be immediately put on and properly fastened before the ship leaves the docks for sea. So powerful has been the gas which has emanated from coals whilst being shot into the lower holds, that on scores of occasions the writer has found it necessary to stop this work so that the gas might escape out of the hatchway, as he feared that if an explosion took place while the coal was being loaded, that the men would be suffocated before the fuel could be taken out of the hatchway. The trimmers, we are also told, have often been severely burnt and injured in various ways, on account of the firing of coal gas in the holds, and their work is always done with fear when they know they can only escape through the hatchway from which the cargo is trimmed.

It is also stated that master mariners frequently complain that the lower holds are not filled full by the trimmers, after the former have been informed by the foreman that the gas is continually lighting therein, and that there is no ventilation. The writer thinks that explosions at sea have in some instances been occasioned by the lower holds not being properly filled, whereby the gas, on account of the ship not being fully ventilated, accumulates in the vacant places. He has always cautioned captains and their officers never to allow lights in the holds, for they are never in his opinion free from marsh gas when they have South Wales coal on board, although he has never heard of an instance of spontaneous combustion from any cargoes of the best South Wales steam coal.

The filling with coal of water ballast tanks which are frequently unventilated, is condemned as a great grievance. These receptacles have but a small hatch of about four square feet for the admission of the coal, and several of such tanks contain from two to three hundred tons of coal. Captains and their officers complain that steamers are not properly trimmed, and 19 out of 20 carrying water ballast have a heavy list of cargo to be shipped after the coal is loaded. This evil is occasioned by the captain or his officers allowing a part of the water ballast to be pumped out before enough cargo is put into the ship to keep her upright in many cases. Unless the captain can be persuaded to prohibit the engineers to start the water ballast they do so whenever they like, while some of them begin pumping out this ballast before the cargo is commenced loading, the result being that before they have half abstracted the ballast "the ship is over on her beam ends, and all the water in the tanks is on one side, and then it is practically impossible to fill the lower holds properly with cargo; steamers carrying water ballast should in no case be allowed to start the tanks until all the lower holds are well filled with cargo, then with good ventilation such as the writer has described, they can be trimmed properly and kept upright." Mr. Rowan who has closely investigated this subject, has offered some very appreciable remarks respecting the dangers from the escape of marsh gas from coal bunkers and holds containing this fuel, through openings and cracks in these receptacles. His caution which appears to have been grossly disregarded, should be particularly borne in mind, he says that "although surface ventilation may prevent explosions in the holds or bunkers, it will not prevent accidents or explosions arising from the fire-damp that may escape through any openings or cracks in them finding its way into other parts of the ship. The gas thus liberated is not only explosive but by admixture with air is also inflammable, and thus becomes the possible medium, when coming in contact with any open light, of conveying flame to parts of the vessel, where explosives, such as gunpowder may be stored, and the results may be therefore far more direful than if the explosion had been confined to the hold."

From a perusal of the condensed reports of the Board of Trade which have been held respecting cases of explosion of coal gas in ships, from 1877 to 1881, several cases are reported where these accidents have occurred from the escape of marsh gas from the holds and bunkers, and coming into contect with naked lights in other parts of ships. We think it opportune to mention one case in particular, to show that there is great danger of an explosion occurring by the escape of such gas even into remote parts of the ship, from the receptacles out of which it is forced.

From a report of the Board of Trade, we are informed that the *Streonshalk*, of Whitby, an iron screw steamship of 1,588 tons gross register, commenced, on the 5th of April, 1879, to take in cargo of newly-wrought coal at Newport, and on the 10th she left that port for Savona with 1,695 tons of this fuel, 338 tons of which were stowed in the fore hold, about 600 tons in the main hold, and the remainder in the after hold. The main hold was quite full, but the coal in the fore hold was sloped away forward, and in the after hold it was sloped away aft, for having the ship trimmed, thereby leaving empty spaces in the fore part of the fore hold and in the after part of the after hold, the empty space in the after hold being capable of containing from five to six wagon loads more of coal. This fuel, which was trimmed into the wings from the centre, had a manhole, or passage down the middle from end to end, to enable the gas to escape. There were also two ventilating pipes in each hold, both of which tubes were about 9 inches in diameter, and fitted with cowls, one being in the fore and the other in the after part of the hold. These tubes came through the upper deck, and stood about 4 or 5 feet above it. Each hold had also two pairs of ventilating bits, with openings of from 3 to 4 inches across. The ventilating tubes had been shut immediately after leaving Newport and the cowls had been stowed away, and on the evening of the 12th, on account of windy weather, the hatches were battened down and the ventilating bits were closed. There was not, therefore, any means by which the gas emanating from the coal in the after hold could escape, except through the grating in the floor of the store room, and as the hatchway over the store room and the ventilating bits were closed, such gas would pass from the store room through the door into the spare berth, and from thence into the saloon. On the 13th an explosion occurred in the after part of this steamer, which entirely destroyed the cabin and carried away the deck above. Besides seriously injuring the master, his wife at the same time, the first mate and steward. The Wreck Commissioners' Court, before which an enquiry respecting this accident took place, were of opinion that "the explosion was caused by the gas escaping from the after hold into the store room through a grating in the floor, which was the only means of escape left open, and thence through the door in the cabin bulkhead into the spare berth, and thence into the saloon where a fire was burning, by which, most probably, the gas was ignited; that the master was not justified in neglecting to ship the ventilating cowls, and in closing the ventilating bits when the hatches were battened down, but they returned to him his certificate."

With the view of better avoiding explosions, we also propose to offer a few important observations upon the better ventilation of coal in ships' holds and bunkers, after having given a short account of other dangerous and injurious gases which exist to a far greater degree than they should do in other receptacles of ships, and several of which injurious consequences can be entirely got rid of, some very nearly removed, and the remainder greatly diminished by the adoption of efficient ventilation.

(*To be Continued.*)

THE "WESTMINSTER" STEAM PUMP.

AMONGST the many admirable exhibits at the Tynemouth Exhibition, we were struck by a very compact and handsome steam pump which we find has been awarded a silver medal (the highest award).

The pump in question, manufactured and exhibited by Messrs. H. Watson & Sons, of Newcastle-on-Tyne, is designed as a water-ballast pump with steam cylinder, 10-in. diameter by 10-in. stroke, and also with a 10-in. pump-chamber. Two boiler feed pumps were also in operation, and were of a similar but reduced type. The main frame, as will be seen from our engraving, is a strong hollow box casting, of which the upper part carrying the working cylinder, forms a capital air vessel of large capacity.

The pump barrel is cast solid with the framing, but is lined with gun metal, so that should bad wear take place the lining can be easily withdrawn and renewed.

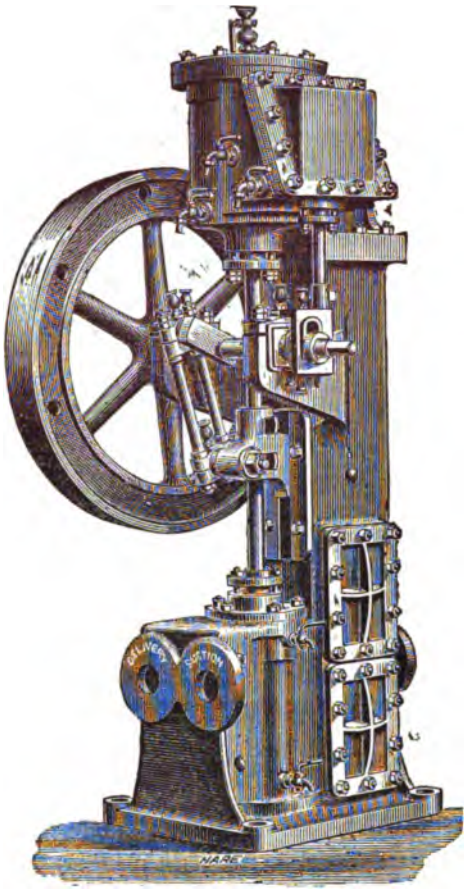
The position and material of the valves is also well chosen. The ballast pumps have gun-metal seats and India-rubber valves, which stand the best against wear and tear under a comparatively low pressure.

The valves in the feed-pumps are very properly also of gun-metal, to stand the high pressure and temperature. The valves are placed by the side of the pump, in the bottom of the main framing on two floors, to which ready access is obtained by side doors.

The steam piston operates by a direct thrust and pull upon the pump bucket, and the engine is regulated and the steam valve moved by a crank shaft, carrying a fly-wheel and operated by a return connecting rod.

This crank-shaft is carried in two ordinary cap gun-metal bearings, in projecting brackets, and thus by removing the cap the crank shaft can be removed without disturbing the piston or pump.

The 10-in. ballast-pump shown is capable of delivering eighty tons of water per hour when running at sixty revolutions a minute, which is a very large duty.



As donkey-pumps of reliable design and workmanship, which will not stop on the dead points and be out of order when most required, are a great desideratum in the Navy and Mercantile Marine, we think this pump will be in considerable demand.

"THE POLYPHEMUS."

THE later trials of this experimental torpedo-ram have been so far satisfactory as to prove beyond doubt the fact that when the necessary improvements are completed, all the advantages claimed for this novel type of war vessel will be fully and completely carried out.

We continually read, in every direction, accounts which all agree in condemning this vessel, and the whole of the fundamental principles of the design. From these statements we gather the information that the *Polyphemus* is a great failure in many leading particulars; 1st, that it is impossible to obtain the specified speed; 2nd, that her stability is doubtful; 3rd, that the torpedoes cannot be discharged under water as anticipated; and, that in many other respects (regardless of this vessel having been built at a great cost) she fails to carry out the primary objects for which she was constructed. Under these circumstances it would be interesting to consider the actual state of affairs as regards the efficiency or non-efficiency of this type of war-vessel, as it seems hard to calmly believe that the highly trained scientific knowledge and practical skill which has been bestowed on her construction has erred so dreadfully in every particular as to produce a gigantic and expensive failure.

One great failure has been pointed out as resulting from the fact that the required speed could not be obtained on account of the difficulty experienced in keeping up the necessary high pressure of steam. This is correct on the face of it, but should be qualified according to the following:—It will be remembered that she was fitted originally with ten locomotive boilers measuring 5 ft. 3 in. in diameter, 14 ft. 4 in. in length, with a special and efficient arrangement of fans for producing forced draught. A series of trials, however, proved that these locomotive-boilers could not be depended upon to act in concert in such a large group, and upon every attempt to realise the specified speed the engines had to be eased on account of excessive priming.

It is well known that the locomotive type of boiler is the standard class fitted in torpedo-launches. In recognition of the special adaptability of this boiler, Messrs. Humphrys & Tennant, of Deptford (who secured the contract to engine this vessel), built a single boiler of the size they contemplated making; they then had a launch built for the purpose of putting this boiler to the most severe tests, and succeeded in satisfying both themselves and the Government authorities that the ten boilers above referred to would answer every expectation. Unforeseen difficulties, however, presented themselves when the connected boilers were set to work, and the ingenuity and skill of the engineers was exercised to the utmost to overcome these drawbacks.

It has been finally decided that the locomotive boilers should be abolished, and the ordinary high-pressure marine boilers, as fitted for years past to H.M. gunboats, be supplied in their place. From the experience gained in former trials the engineering authorites have no doubt that, with this arrangement, they will be able to sustain the high pressure of steam required, and thus fulfil these vital conditions. It must be remembered in considering this matter, that this was entirely an experimental arrangement, which, although in the first instance resulted in a temporary failure, has nevertheless been (theoretically) rendered successful by the alterations given above.

As regards the engines, though many changes from the ordinary type of engine have been introduced for the purpose of economising weight and space, they have carried out everything required, and no doubt is entertained as to their sustained efficiency when working at full speed.

Leaving the steam-producing and propelling properties with these remarks, we next come to the question of discharging her torpedoes under water. It must be well known that special fittings have been arranged in this vessel to enable her to discharge torpedoes from the bow, right ahead, or from either broadside, at right angles, and, varying degrees of angle, with the keel, under water, at any rate of speed. Very little difficulty was experienced in obtaining the right ahead fire, but it was found impossible to carry out the broadside discharges at high rates of speed. When we say high rate of speed, we would state that up to twelve knots per hour this could be carried out with every desired effect, but above twelve knots this could not be done. From the results of various experiments the architects have now perfectly satisfied themselves that they can overcome this difficulty, and thus another experimental feature will be successfully overcome.

Having noticed the temporary failures caused by priming, and the difficulty of discharging the broadside torpedoes, each of which we are led to look upon as practically removed, it would appear that the failures end here, and that all the other points of the design are complete in every respect. As regards the form for speed, it has been fully proved from the speeds obtained in past trials, with a limited number of revolutions per minute, that when the steam can be obtained to develope the full power, the speed will exceed that originally specified. As a ram her efficiency is unquestioned, when completely equipped she floats at her designed load line; no doubt exists, amongst those qualified to judge, as to her stability; her steadiness has been proved in some very rough weather, and her steering qualities are not surpassed by any vessel in H.M. service.

The extra cost complained of must be expected in an undertaking combining experimental arrangements of such an extensive nature, and we hope, when the improvements above explained are carried out, to record the fact that this outlay has not been wasted.

CASUALTIES AT SEA.

AT the present time the growing necessity for providing additional harbours at prominent points of our coast is exercising the minds of numbers of leading authorities deeply interested in adding to the safety of our great mercantile coasting fleet.

The wreck registers for many years past show a deplorable loss of lives and property, attributable to a variety of causes. To some extent these losses come under the designation which entirely absolves any human agency from blame or shortcoming in the matter; such disasters as these are attributed to the "Will of God," and illustrates the futility of weak mortals attempting to combat successfully, by means of mechanical inventions, against the laws and forces of nature.

Independent of losses which must be considered as beyond human control, many disasters occur, the extent and nature of which may be considerably lessened by taking precautions which experience and practice proves to be absolutely necessary. The ingenuity and skill of the naval architect, the marine engineer, and the navigator, has been taxed and improved upon in almost every conceivable direction, to ensure the safety of the great and ever-increasing numbers of vessels, human lives, and merchandise wafted incessantly on the bosom of the ocean to every part of the navigable globe.

The *Wreck Register* for 1880-81, recently issued under the sanction of the Board of Trade, shows that the number of wreck casualties and collisions on the coast of the United Kingdom alone amounted to 3,575. These disasters are very appalling in themselves, but when the record proves that 984 valuable lives were also lost, this matter assumes a serious and lamentable aspect.

The 3,575 wrecks, casualties, and collisions which have occurred on or near the coasts of the United Kingdom during the year 1880-81, comprise 4,297 vessels more or less damaged. This excess is caused by the fact that in cases of collision two or more ships are involved in one casualty. From the last annual statement of navigation and shipping, it appears that the number of British and foreign vessels that entered inwards and cleared outwards, to and from ports of the United Kingdom last year, including their repeated voyages, was 668,000, representing a tonnage of 134 079,623 tons. It will not be an over estimate to state that between three and four millions of persons were carried on board on all occasions. The annual record of the National Lifeboat Institution has periodically called attention to the shipwrecks on our coasts, as follows:—in 1855, 1,141 vessels were wrecked; in 1856, 1,153; 1857, 1,143; 1858, 1,170; 1859, 1,416; 1860, 1,379; 1861, 1,494; 1862, 1,488; 1863, 1664; 1864, 1,390; 1865, 1,656; 1866, 1,860; 1867, 2,090; 1868, 1,747; 1869, 2,114; 1870, 1,502; 1871, 1,575; 1872, 1,958; 1873 (first six months), 967; 1874, 1,803; 1875, 3,590; 1876, 3,757; 1877; 4,164; 1878, 3,641; 1879, 3,002; 1880, 2,519, and 1881, 3,575. This makes in all for twenty-six years a total number of wrecks of nearly 55,000 vessels, and the dreadful total of 19,503 lives.

It is, however, gratifying to state that during the period referred to the lifeboats of the National Lifeboat Institution were the means of saving over 12,500 lives, and in addition to this since the formation of the institution 29,181 lives have been saved through their agency.

Still, although the lifeboats and life-throwing apparatus save an immense number of lives, it is a most astounding and serious fact that the number of shipwrecks on our coast every year is overwhelming, and defies all applications for their prevention or even appreciable diminution.

It is distressing to observe that the number of English ships, excluding collision cases, which have foundered or been otherwise lost on and near the coasts of the United Kingdom from defects in the ships or their equipments during the year is 34, whilst 92 happened through the errors, &c., of masters, officers, crews, or pilots, 319 through stress of weather (or by the will of God) and 95 from unknown causes. The number of wrecks which occurred during the year 1880-81 is larger than that of the previous year by 1,159. These are made up as follows: 713 were collisions, and 2,862 were wrecks and casualties exclusive of collisions.

The localities of the 2,862 wrecks are:—East Coasts of England and Scotland, 1,088; South coast, 503; West coast of England and Scotland and coast of Ireland, 987; North coast of Scotland, 82; and other parts, 202. The deplorable loss of life in each locality, including collision cases, is as follows:—East Coast, 585; South coast, 94; West coast, 162; North coast, 54; and other parts of the coast, 89. These startling figures will at once explain the cause of the agitation now existing as to the necessity of providing harbours of refuge (especially on the east coasts) for the safety of distressed and storm-tossed vessels and crews. The ages of the vessels wrecked during the period referred to, excluding collisions, are thus given by the register:—146 disasters happened to nearly new ships, and 322 to ships from three to seven years of age. 500 to ships from 7 to 14 years old, and 932 to ships from 15 to 30 years old, older vessels were 463 from 30 to 50 years of age, above the half century, viz., between 50 and 60 years old, 59; between 60 and 70 years old, 34; between 70 and 80 years old, 6; between 80 and 90 years old, 7; from 90 to 100 years old, 5; and above the patriarchal century six vessels were wrecked whose exact ages would be most interesting to know. The casualties to ships in our rivers and harbours continue to be very numerous, the number during the year last recorded being 821, of which number 31 were total losses, and 790 casualties of a more or less distressing nature. Of these, collisions numbered 540, founderings 14, strandings 180, and from other causes 87. The lives lost in these casualties fortunately amounted to only 13.

Looking seriously in the face of such glaring and important statements, it becomes the duty of the naval architect, marine engineer, ship surveyor, and navigating authorities, by a mutual combination of knowledge and skill, to devise any and every possible measure necessary to alleviate such disastrous calamities. There are many points to be considered and party questions to be solved before the combination of talent above referred to can be induced to amicably and peacefully undertake this important task in a kindred spirit. No profession or class cares to bear the odium of being solely responsible for such enormous and dreadful losses. Yet we must say that every individual section of the maritime community seems desirous to consider its own special body as free from blame, and to proportionately saddle others with want of care or attention in this direction.

To assist as far as possible in solving the question at issue, as to the extent to which each department should be called upon to exercise its functions in improvements in their respective possessions, it is necessary to consider more minutely the main causes to which losses and casualties at different times are wholly and solely attributable. There are many different actual causes which it is our intention to regularly point out from particulars of casualties to hand in future issues, which will set before all classes and professions whenever such details can be obtained, the prime and particular cause which should receive their particular consideration.

ON MODERN MERCHANT STEAMERS.

(*Continued from page* 233.)

The *Agia Sofia*, 2586 tons, owned by Papayanni & Co., was struck by the *Newton* while lying in the Mersey, with 2300 tonsa of cargo on board, in September, 1880. She was cut down to 2½ feet below the water-line, but her bulkheads kept her afloat.

The *Anchoria*, 4457 tons, of the Anchor Line, was struck by the *Queen*, 4457 tons, 300 miles from Sandy Hook, in June, 1880. She was struck nearly amidships, and had 28 feet of water in the compartment, but her bulkheads saved her.

A similar case was that of the *British Queen*, of the Cunard Line, in the Mersey in 1867.

The *City of Agra*, City Line, was struck 8 feet abaft engine-room by the *Nepthis*, at the mouth of the Mersey, in November, 1880. She was cut down to within 8 feet of the keel, but the bulkhead dividing the after hold, though damaged by collision, saved the ship.

The *Helvetia*, 4588 tons, of the National Line, was in collision with the *Mona* in the Mersey, in January, 1881. She was cut down several feet below water in after hold. The compartment filled, but the bulkhead saved the ship.

The *Sutherland*, 959 tons, of the Leith and Hamburg Line, was cut down by the *Duchess of Sutherland*, going 14 knots, off Holyhead, in July, 1877. The after hold filled, but the bulkhead at fore end saved the ship, and she steamed into Holyhead.

The *Utopia*, 2731 tons, of the Anchor Line, was struck by the *Merlin* in February, 1878. Fore hold, 60 feet long, filled; but bulkheads kept the ship afloat.

There are many other instances of a similar kind, but these will be enough to show that bulkheads are structurally strong enough to resist the pressure of water upon them.

A large part of this paper has been taken up by the question of water-tight subdivision, but you will perhaps pardon this, in consideration of the very great importance of the change which is thus taking place in merchant steamers, both from a commercial and military point of view.

Another change is in the increasing breadths of many modern steamers. This has been largely due to those experiments which have shown that economical results are by no means confined to ships of excessive length. It is a change of great importance, for three reasons:

In the first place, the shorter ships are handier ones; in the second place, they have presumably greater stability; and in the third place, the increase of beam makes it possible to place a block of coal of considerable thickness at the sides of those portions of the machinery which are above or near the water-line.

In 1878, and again last year, some interesting trials were made of firing shells at loose coal, representing the bunkers of merchant steamers. The general result was that the thickness which can be got in ordinary steamers is sufficient to stop shells from the heaviest guns in general use in unarmoured war vessels. And the greater beams now becoming common make it possible, with some thin loose armour-plates, such as might easily be used in case of necessity, to stop shells even from the powerful 6-in. and 8-in. breech-loading guns of Sir William Armstrong. This increase of resisting power is an important consequence of the increasing beams of modern steamers.

A considerable change in the forms of modern steamers has come about through the explosion of the old notion that the form and area of midships section were all-important elements in economy of speed results. Steamers have no longer the great rise of floor formerly common, and have consequently greater cargo capacity.

In these alterations of forms, and in other matters, we are indebted to a considerable extent to those shipbuilders who have so wisely and successfully availed themselves of the results of modern science.

Then there is the very common use of double bottoms. They are of very great use in case of a vessel getting ashore—most of all when she runs over a reef into deep water. This is a case which traverse bulkheads may fail by themselves to meet.

The steering power of merchant steamers has been increased, not only by the adoption of more moderate proportions than those in use a few years ago, but also by the introduction of steam-steering gear. It might be still more largely increased by increasing the rudder area, which is still about the same as when hand power only could be used. In that case the rudder posts would require strengthening, and this appears to be so even now, if we may judge by the frequent disablement of steamers through injury to the rudder posts.

The same results have been aided by the introduction of twin screws into our large merchant steamers. It is quite true that at present it has been only an introduction; but I hope that the three large twin-screw steamers built last year, and the two building now, will prove to be the commencement of a very general practice. That there is a serious drawback in the extra care required in docking, no one doubts. And many small cases of injury to the screws might occur; but they would occur where there is every means of repairing the damage, and not like accidents to single screw ships, far away from port. Large and valuable vessels are now continually breaking down in mid-ocean by the failure of some part of their machinery. This will be practically impossible in a twin-screw steamer, and will save the expense of towing into port, of the consequent delay, and of repairing the ship away from home, or towing her all the way back again. Twin screws have given to war ships, and will yet, I hope, give to merchant ships, a practical immunity from the perils of machinery breakdowns in mid-ocean, and a reliable steering apparatus in reserve.

Summing up the foregoing statements we have then:

1. The British mercantile marine has grown to an unprecedented extent, and has acquired a larger part of the trade of the world than it ever carried before. Each change in the conditions of trade has appeared to favour it, and our advantage is likely to continue for some while to come.

2. The best method of defending this marine in war time has been a subject of frequent discussion. And one element in the question is the fighting power of modern merchant steamers.

3. During the last few years important changes have occurred in merchant steamers. They have acquired:

(1) Increased speed.
(2) Increased coal endurance.
(3) Greater structural strength.
(4) Much better water-tight sub-division.
(5) Improved pumping facilities.
(6) Greater beam.
(7) Double bottoms.
(8) Steam-steering gear.
(9) In a few cases, twin screws.

These are some of the chief changes which have occurred during recent years in modern merchant steamers. They have come about to a very large extent as the natural development of our merchant trade. In part they have been due to special effort. They have all improved the commercial value of the ships themselves, and, in that sense, have been of value to the nation. But they have, perhaps, been of almost equal importance in the degree to which they have affected the conditions of those problems which have so continuously varied during recent years—the naval defence of this country and the provision for the safety of its merchant marine in war.

In this way I trust that a statement of facts, without any expression of my opinion on them, may be of interest to some of you, as being, to a large extent, the authors of these changes, and of service to the Institution as affording a basis for the discussion of a subject so interesting to all of us—the maritime strength and security of the British Empire.

THE GEOMETRY OF THE SLIDE AND EXPANSION VALVES.

I.

In these articles it is intended to show how the motion of the slide and expansion valves, and the consequent control over the admission and eduction of steam to and from the cylinder, may be represented by a geometrical method introduced first by Dr. Gustav Zeuner, of Zurich*; it is hoped that the simplicity and usefulness of this method will commend itself to our practical readers, as by it many important questions regarding valve settings, &c., can readily be answered as well and as accurately as by the troublesome operation of turning the engine by hand and proceeding by actual trial, an operation which in large engines enters not only into a deal of labour, but also occupies a considerable time, and interferes with other work being done to the engines, and this often at a time when every hour is of considerable importance.

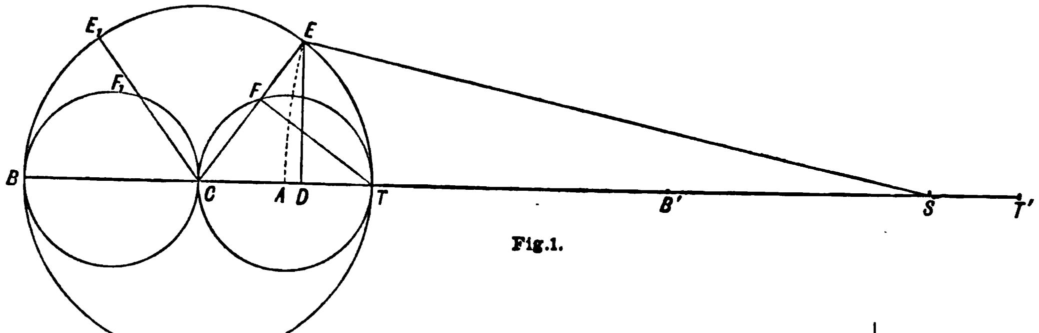


Fig. 1.

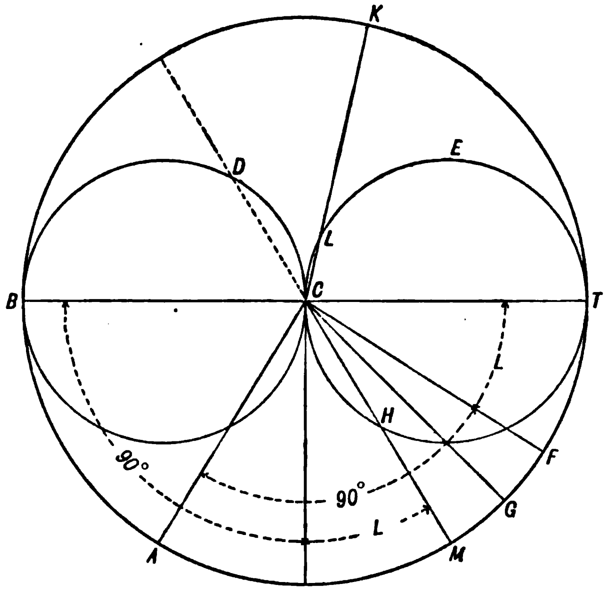


Fig. 2.

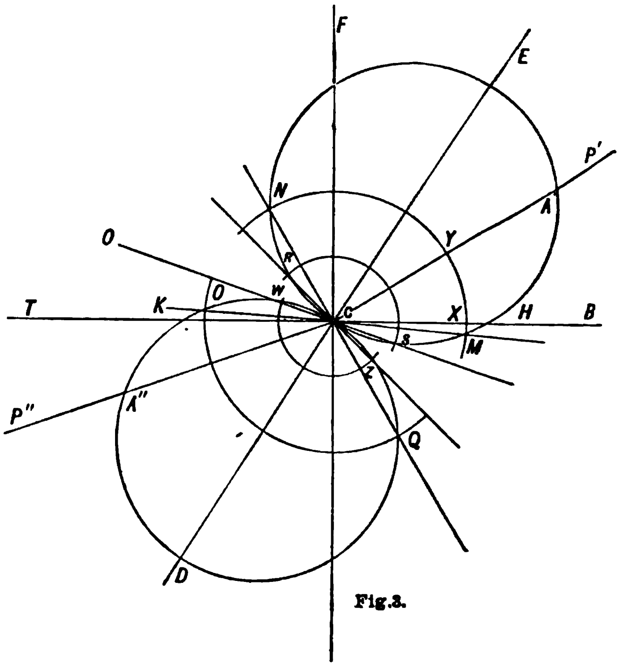


Fig. 3.

As a preliminary, we must first consider the actual motion of the valve as controlled by a single eccentric.

In Fig. 1 let C be the centre of the crank shaft, C S T^1 the centre line of the slide, C E the eccentricity of the eccentric, E S, B B^1, T T^1 the length of the eccentric rod measured between the centres. The circle T E B will be that described by the centre of the eccentric sheave. B^1 and T^1 will be the bottom and top position of the lower point of the slide rod, while by taking E S=T T the length of the eccentric rod, S will be the position of the point of the slide rod corresponding to the position E of the centre of the eccentric sheave. If now with S as a centre, we draw the arc E A through E, we shall have A T=S T^1 (since A S=E S=T T^1). If therefore we consider BT to represent the travel of the slide due to the complete revolution of the eccentric, the point A will represent the position of the slide when the centre of eccentric is at E. If now the length of the eccentric rod be great compared with the throw, as is nearly always the case in practice, the arc E A will sensibly coincide with the line E D drawn from E perpendicular to B T, and D the foot of this perpendicular may therefore be taken to represent the position of the slide corresponding to the position C E of the eccentric.†

If we draw upon B T two circles, C F T and C F B, each having a diameter equal to half that of the larger circle, we shall find that if F be the point in which C E cuts these circles, C F will be equal to C D (for if F T be joined, it is seen at once that the triangles C F T and C D E are similar and equal in all respects), but C D is the distance of the valve from the middle point of its stroke; hence we have the following:—*If E^1 be the position of the centre of the eccentric, and E^1 C be joined, cutting the small circles in F^1, then C F^1 will be the distance of the slide from the centre of its stroke*, and this thoroughly determines its position.

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* An English translation of Dr. Zeuner's work, giving the mathematical solution of many problems concerning various valve gears, is published by E. & F. N. Spon, London.

† If the length of the eccentric rod be 12 times the travel of valve, a proportion often exceeded in practice, the greatest error introduced by drawing ED perpendicular, instead of an arc of a circle, is only one per cent. of the travel, while if the rod be longer the effect is proportionally less.

Now what is generally required to be known is not what is the position of the slide corresponding to a given position of the *eccentric;* but what is its position corresponding to a given position of the *piston*, or to a given position of the crank.

In Fig. 2, if, as before, C be the centre of the shaft, B T the line of centres, C T=B C=half-travel of the valve. B D C, C E T circles described on C B and C T as diameters, then for any position M of the centre of the eccentric, C H will be the corresponding distance of the slide from the middle point of its travel; but the eccentric is always 90 deg., plus the angle of lead in advance of the crank. Hence, if we make the angle T C A=90 deg. + ∟ the angle of lead, we shall obtain C A, the position of the crank when the slide is at the extremity of its stroke. Similarly, if we make B C M =90 deg. + ∟, we find M the position of the centre of the eccentric, and C H, the distance of the slide from the centre of its travel at the time the crank is in the position C B, or at the bottom centre; and again, if we suppose the crank to be at the position C G, and make the angle G C K=90 deg. + ∟, we shall have C L, the distance of the slide from the centre of its motion at that instant.

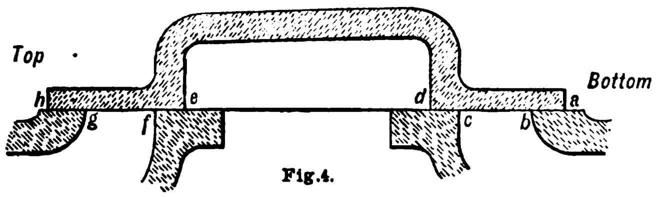
Top
Bottom
h
e
d
a
g
f
c
b

Fig. 4.

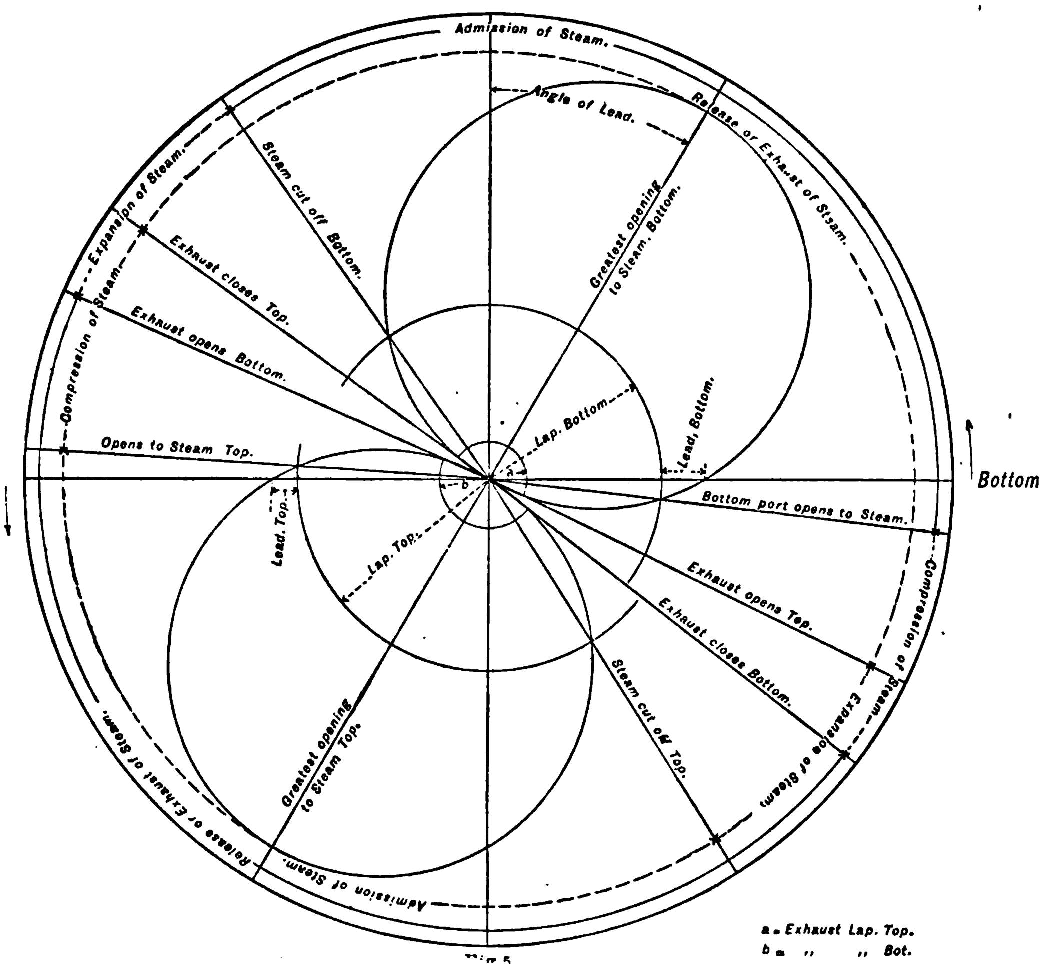
Admission of Steam.
Angle of Lead.
Release or Exhaust of Steam.
Expansion of Steam.
Steam cut off Bottom.
Greatest opening to Steam. Bottom.
Exhaust closes Top.
Compression of Steam.
Exhaust opens Bottom.
Lap. Bottom.
Lead, Bottom.
Opens to Steam Top.
Top
Bottom
a
b
Bottom port opens to Steam.
Lead. Top.
Lap. Top.
Exhaust opens Top.
Compression of Steam.
Exhaust closes Bottom.
Expansion of Steam.
Steam cut off Top.
Greatest opening to Steam Top.
Release or Exhaust of Steam.
Admission of Steam.
a = Exhaust Lap. Top.
b = " " Bot.

Fig. 5.

Now it would be, to say the least, very inconvenient to have continually to be measuring angles to find the position of the crank, but we conceive the figure turned round through the angle 90 deg. + ∟, so far as the cranks alone are concerned, we shall have, then, the same line representing the positions of the centre of the eccentric and the crank. Or, in other words, if we now assume C M to be the position of the crank when at the bottom centre, C H will represent the position of the slide at that time.

To see this more clearly let us refer to Fig. 3. Let B C T represent the line of centres of the crank, draw C F perpendicular to B T' and make the angle F C E=L, produce E C to D, making C E= C D=half-travel of the slide, and on C E and C D describe the circles C H E, C K D. Then, by comparison with Fig. 2, we see at once that C H=distance of the slide from the centre of its travel when the crank is at C B or on the bottom centre, also that when the slide is at the end of its travel, a distance C E from the centre, the crank will have turned through the angle B C E (in Fig. 3, equal to the angle B C A in Fig. 2); and similarly that when C P', C P", &c., are the position of the crank C A', C A", &c., will be the distances of the slide from the centre of its travel, noting that if C B represents the positions of the crank when on the *bottom* centre, and C T its position when on the *top* centre, the slide will always be *above* its central position when the line representing the crank in the figure cuts the *upper* circle, and *below* its centre when the line cuts the *lower* circle.

Now in the slide in Fig. 4, (which is a single ported one, but the principle is precisely the same in a double ported slide), we have supposed the slide placed in the centre position; the slide overlaps both steam ports, both on the steam side and on the exhaust side. The distance *a b* is termed the *lap*, and *c d* the *inside lap*, or the *exhaust lap* for the bottom end of the cylinder, and *h g* and *f e* are respectively the *lap* and the *exhaust* or *inside lap* for the top end of the cylinder.

It is seen at once that when the slide is moved the distance *a b* towards the *top* end of the cylinder the steam port for the *bottom* end is just on the point of being opened, and if it be moved the distance *e f*, in the same direction the top port is on the point of being opened to the exhaust, and also if the slide is moved the distance *g h* towards the bottom end the *top* steam port is on the point of opening to steam, and if the distance *c d* the bottom steam port will be on the point of opening to exhaust.

If now we suppose the travel of this valve to be that represented in Fig. 3, and with C as centre and C M equal to *ab* as radius, we describe the part of the circle NYM cutting the upper valve circle in N and M, we see that the slide will be moved through a distance *ab* towards the upper portion of its travel when the crank is at C M, and also when it is at C N, hence C M is the position of the crank when the port is first just opening to steam, and C N its position when it is just closing or cutting off. Also in any position of the crank, such as C P^1, C A^1 is the distance which the slide has moved from the centre and C Y=*ab* the lap, hence Y A^1 is the amount the port is open at that instant, and hence also X H is the amount the steam port is open when the crank is on the bottom centre, or in other words X H is the *lead*. Further, if we draw the circular arc W Z with a radius=*cd*, the inside or exhaust lap, cutting the lower circle in W and Z, then C W will be the position of the crank when the exhaust port commences to open, and C Z its position when it just closes, or when cushioning or compression of the steam commences.

Similarly, if with radius C O=*gh* the lap of the top port we draw the circular arc O Q cutting the lower valve circle, we obtain C O the position of the crank when the port commences to open, and C Q its position when it is closed or cut off, and if we draw the arc RS cutting the upper circle in R and S, the radius C R being equal to the inside lap *ef*, we get C S the position of the crank when the port opens to exhaust, and C R its position when it closes again.

It is to be observed that in the case in which the exhaust or inside lap is negative, that is to say, in the case in which, when the valve is in the centre of the travel, either or both of the steam ports are open to the exhaust, instead of being covered as in Fig. 4; we must draw the circular arc representing the exhaust lap, cutting the other circle to that in which it should be drawn when the inside lap is positive.

In Fig. 5 we have, drawn to a somewhat larger scale, a diagram shewing the various points which can be determined from it by inspection.

From this diagram it is easily seen, the angle of lead being the same, that the sum of the lap and lead is constant; so that if we increase the lap by a given amount we decrease the lead by the same amount, and *vice versa*. Also that the greater the lap the earlier will be the cut off, and the greater the expansion, and the less will be the opening of the port to steam at all times; and, further, we see that the *greater* the inside or exhaust lap the *later* will the exhaust open, and the *earlier* will it close, and, of course, the *less* the inside lap the *earlier* will the exhaust open and the later will it close.

It is also evident from the diagram that, the lap and exhaust lap remaining the same, the greater the angle of lead the greater will be the lead, and the earlier will be the cut off, the release or exhaust of the steam and the closing of port to exhaust, or commencement of cushioning will also be earlier.

Further, it also appears that, provided it is possible to alter the throw of the eccentric, the lap, inside lap and angle of lead remaining the same; the greater the travel given to the valve the *lead* will be greater, the cut off later, the exhaust earlier, and the compression later; and conversely, the less the travel the less will be the *lead*, the earlier the cut off, the later the exhaust, and the earlier the compression.

It thus appears that any alteration of either the travel, angle of lead, lap or exhaust lap in any valve, alters more than one of the critical times of the admission, cut off, exhaust, and compression of the steam, and may possibly alter them all. It is, therefore, generally necessary, when one of these details of the valve is altered, in order to alter the distribution of the steam in some particular way, to alter one or more of the others in order to prevent an unfavourable, or perhaps a very undesirable, alteration in the action of the steam in other respects than in those wished for. A careful examination of the diagram will show at once the amount of influence any given alteration of the valve or gearing will have, and also the amount of alterations in other respects necessary to counterbalance any effect which may not be desired.

The diagram also shows very clearly the effect of having the slide too high or too low upon the slide-rod. If the slide is too low, the lap on the bottom port is increased, and that on the top port is lessened, while the exhaust lap on the bottom port is decreased, and that on the top port is increased. On the bottom end of the cylinder, therefore, we obtain less lead, an earlier cut-off, an earlier exhaust, and also a later closing of the exhaust port; while on the top end we get greater lead, a later cut-off, later exhaust, and an earlier cushioning.

We have by no means exhausted the information given by this diagram in the case of a slide worked by a single eccentric, which, it may be observed, is the case of slides worked by means of the ordinary link motion when the eccentric-rod is in a line with the slide-rod, and it will well repay a careful study on the part of anyone interested in the working of slide-valves. The principle of the diagram can be applied also to other cases of valve motions common in practice, such as the ordinary slide when *linked up;* to the cases of expansion valves, working either on the back of other valves or on separate faces, and to the different forms of variable expansion gears which are more or less in general use; but these cases must be left for a future article.

(*To be continued.*)

ON THE TRIPLE EXPANSIVE ENGINES OF S.S ABERDEEN, AND THE ECONOMY OF COMPOUND ENGINES*

By A. C. Kirk & W. Parker.

DISCUSSION ON THE PAPERS.

MR. WILLIAM DENNY: We have not as yet made any experiments on triple expansion engines, but we are going to do so in a small steam tender we are building for ourselves. We are building her with compound engines, but with a boiler of sufficient strength to stand 120 lb. pressure. We are going to try these engines with 90 lb. pressure, and then we propose afterwards putting on a third tandem cylinder for the purpose of making it into a triple expansion engine, then raising the boiler pressure to 120 lb. and trying what the result is with two engines.

Mr. Longridge: The principal object of these papers appears to me to be to prove first that high pressures are the only means by which we can now realise economy, and secondly, that practically to realise the economy due to those high pressures, we must increase the number of cylinders. I cannot agree with that proposition as far as I can see the arguments for and against it. Mr. Kirk's paper brings an argument forward. He says that when the steam pressure was raised from 15 lb. to 60 lb., half the coal was saved. I maintain that the coal was saved because the pressure was raised. In the nature of things the old marine engine was non-expansive—it could not be otherwise. If the steam had been cut off earlier the mean pressure would have been so much reduced that the back pressure would have borne a very formidable proportion to it. That was the cause that prevented the expansive working in the early marine engines. With higher pressure the steam could be expanded and the engine made moderately expansive without dispensing with our old friend the common slide valve, but if the steam had been expanded in the single cylinder, a similar result would have prevailed. I propose to refer merely to the result of experiments. Experiments have shown that to every engine there is a certain ratio of expansion at which it works most economically. At 60 lb. pressure this ratio is about seven expansions in the single cylinder. In a compound engine with cylinders one in two, eight failed; in the compound engine with cylinders one in three, ten; and one in five, fifteen failed. These results are deduced from experiments for the purpose of determining the point. A further result of those experiments is that the consumption in all this class of engines is equal to 60 lb. pressure, and that consumption is equal to about 18 lb. of water per horse power. I myself have made experiments in the same direction which entirely concur with those. I have also made experiments with 80 lb., and I have found that the consumption of such types of engines when working at their proper ratios of expansion was about 16¾ lb. of water. Therefore I maintain that if we are to argue anything by analogy, we should argue that the consumption of all classes of engines working at 80 lb. will be 16¾ lb. of water per working horse power per hour. According to my experience the saving is this—at about 60 lb. we shall save about half a pound of water for every 10 lb. rise of pressure, but as we go up the scale the saving becomes less and less. I quite agree with what Mr. Kirk says that we are now probably very near the limits that can be got by increasing the pressure. As far as experiment goes, the result of saving two or three per cent. is the same whether you work steam with the two cylinders, provided you work that particular engine at its right ratio of expansion. That is the main point, but there is one way in which I think steam can be economised, and that is by superheating. A higher pressure has been obtained with 40 lb. pressure, with steam superheated twelve degrees, with 15½ lb. of water. Now that I maintain is a result which, if it does not equal, very nearly approaches what can be got out of these three-cylinder engines with 125 lb. pressure, and I do say that is a question to be considered. Surely it cannot be beyond the mechanical science and ingenuity of this country to be able to produce it.

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* Read at the Twenty-third Session of the Institution of Naval Architects.

Mr. Scott: My lord, I was one of those who commenced the introduction of the compound engine at the very early period of 1858. I commenced with the use of steam at 125 lb., which Mr. Kirk has now been experimenting upon. I was obliged to abandon the use of that pressure because the boilers we then attempted to use, as happened with Mr. Kirk in 1874, failed in continuous practice. Although after that period, in 1860, I recommenced with pressures of 60 lb., I never lost faith in a pressure for practical purposes of 125 lb., or even more. When I used that pressure in 1858 and 1860, only two cylinders were used in working that steam. If my recollection serves me right, the results which we obtained were not very different from those which Mr. Kirk has brought before us to-day as a greater economy. That system was abandoned at that time simply from the failure of the boiler, and not because we were disappointed with the result of the engines. Nobody, until Mr. Kirk led the way with this boiler, as fitted to the *Aberdeen*, has had the courage to use steam of 125 lb. at sea in a boiler of ordinary marine type, and I think Mr. Kirk deserves a great amount of credit for having been so bold as to do so. Now, my lord, with regard to the curves which I see drawn on the diagrams here with reference to the question of the difference of economy to be expected between the use of three or four cylinders and two cylinders. In using an adiabatic curve, such as those shown on the diagrams there, the measure of the loss caused either by condensation in the cylinder and re-evaporation, or any of the other losses, must be measured by the differences of areas between the curves projected from the actual indicator curves and that shown by the diagram. Now, in comparing the various curves produced by Mr. Parker and those produced in Mr. Kirk's paper, I must confess that going roughly by the eye I do not see any very large difference of area presented by those curves. It strikes me that shown from the tandem engine of the *Ludgate Hill* with the two cylinders, does not very largely differ from that shown by the triple cylinder engine of the *Aberdeen*.

Mr. E. A. Cowper; My lord, I have drawn here two diagrams in order to try to show distinctly the difference between the area that can be obtained with 90 lb. steam in a compound engine, and what would be the effect with three cylinders, supposing the steam is 125 lb. to the inch. That is 90 lb. and that is 125 lb. [illustrating]. Now, theoretically, that ought to be obtained by Mr. Kirk by going to 125 lb. pressure. I have not rounded off the corners so much as they would be rounded off in practice, because I wished to show, as nearly as I could, the true expansion curve—what the amount of power is that should be obtained. Therefore I should be very glad indeed, having had something to do with the compound engine, if Mr. Kirk can get that bit between the 90 lb. and the 125 lb. However, that is all that is on the cards, and no more is to be got than that. Now, taking the observations of Mr. Parker in reference to the steam being condensed first in the one cylinder and further on in the second cylinder, and passing out as water into the condenser, I must take exception to that statement. He did not state in the paper whether the cylinders were steam jacketted. I drew attention to that effect when I first introduced my arrangement for compound engines in 1857, and I afterwards improved it in 1862. It was done in this way. There was a steam jacket reservoir; there was a liner inside here, open at one end and closed at the other. As the steam passed through from the high-pressure cylinder, it passed into the middle of this space without rubbing against the steam jacket at the side, and it did not increase the back pressure at all, and did not expand the steam at all, but when it passed from there to the low pressure cylinder, it passed round the edge of the liner and rubbed itself against the steam jacket inside all the way round. I am afraid in many of the compound engines which are now made with steam jacketted reservoirs in that way they do not put the liners in, and therefore they do not get the full advantage of superheating the steam where it passes out. This is a diagram showing the steam expanded as in that figure. This red line is the true expansive curve, and this other figure is the low pressure. Instead of having any portion of the steam thrown away as water, as suggested by Mr. Kirk, we have the steam slightly superheated. The consumption of fuel which Mr. Kirk has spoken of, 1.28, I am very glad to hear of, but I should have thought that it would have been better for 150 lb., I myself having many years ago done 1.3. One reason is in the *Aberdeen* that he does not follow the expansion curve far enough—he should expand more in each cylinder. There is a large notch between each of those figures because the running of the curve is not followed. It does not expand enough in the horse power curve or in the intermediate cylinder. That is only 12 per cent. altogether. I need not mention that the difference between 1.3 and 1.28 is not anything like 12 per cent., but is only 1½.

Mr. Macfarlane Gray: The advantage in efficiency of increasing the pressure from the usual 60 lb. steam, that is 75 lb. gross to 124 lb. gross, theoretically amounts to about 16 per cent. The mean pressure during admission is, say, only 110 lb. (all the pressures will be given gross pressures), the gain would be in that case theoretically only 12½ per cent. I think that only about 9 per cent. increased efficiency can have been realised, that will amount to about 8½ per cent. of fuel saved, but say that 10 per cent. of the fuel is saved. The question is, is it worth while to add a cylinder and to, say, double the boiler pressure to save 10 per cent. of the present consumption of fuel. Thinking back upon previous advances in economy we must bear in mind that at the beginning of compounding and surface condensation 10 per cent. saved would be 10 per cent. on about 4 lb. per reduced horse power, while it is now 10 per cent. upon only 2 lb., or equal to what 5 per cent. was then. Ten per cent. less coal to be carried, even on the present diminished consumption, may be a sufficient inducement to adopt engines of this type for the China trade, in which the *City of Aberdeen* is to be employed, but, on comparatively short voyages the increased first cost and increased tear and wear will, I think, more than counterbalance the gain. In Mr. Parker's paper the process by which what is originally "dry saturated steam" does work is described. In my paper on thermodynamics, two years ago, I suggested that this term "saturated steam" should be given up as misleading. I consider that steam as obtained from the boiler is steam gas containing more or less moisture. The steam cannot be said to be *saturated* with moisture, for liquid particles continue to be formed in it during expansion. A perfect gas is matter travelling in single molecules, aggregations of molecules constitute liquid particles, each aggregation, however, still counting as one gas molecule, the additional molecules counting as liquid. This view of steam which I am working out has also since been advanced in an article by Clausius in the *Philosophical Magazine* in June, 1880. The long time I have allowed to elapse between reading my paper and preparing it for the press is principally due to this, that although on every side I obtain remarkable corroborations of the soundness of my deductions they in respect to the varying specific heat of liquid water, to a small extent violate the second law of thermodynamics while they agree with the first law. I am trying either to explain away that disagreement or otherwise to heap up experimental corroborations to support my deductions in their violation of the second law, which, except for a perfect gas, is admittedly based on a mere assumption. What is called dry saturated steam at a given temperature is boiler steam at that temperature of maximum pressure with the supposed minimum amount of moisture. Otherwise it may be described as boiler steam at a given pressure at minimum temperature containing minimum moisture, or simply dry steam. In Regnault's experiments on latent heat the steam contained .992 of steam gas and only .008 of moisture. The proportion varies irregularly, and at the highest pressures experimented on 200 lb. pressure, the moisture amounted to only 2 per cent. In Mr. Parker's paper the nine-tenth formula approximation is employed. I make the decrease of the *p. v.* product to be more rapid in adiabatic expansion than that obtained by that formula. The following Table gives some notion of the order in which condensation proceeds, beginning without moisture:—

Pressure.	Steam Gas.	Moisture	*p. v.* New.	*p. v.*
lb.				
124	1000	0	1000	1000
70	966	34	916	944
44	943	57	860	902
30	924	76	816	868
14.7	890	110	745	808
6.9	860	140	682	748
1.5	811	189	582	643

The column headed "*p. v.* new" is the *p. v.* according to my graphic method. The last column gives the *p. v.* by the formula employed for the adiabatic curve in Mr. Parker's paper. Either of these shows that the old rule *p. v.* constant cannot be applied when such a range of pressures has to be dealt with. If the steps between exhaust and inlet involve no loss of heat the *p. v.* product will be a little more than what are given in the second last column, which refers to perfectly adiabatic expansion. The adiabatic curve exhibited on a diagram at low pressures is not easily estimated by the eye, which can with difficulty take in that; a little up or down means a strip of area of that breadth the whole length of the diagram, where the curve is steep the differences are seen more clearly. With regard to the practical value of steam jackets, I have frequently been told by seagoing engineers, that they never put steam into the jacket except before taking an indicator diagram, because they cannot keep up steam with the jackets in use. With the steam jackets they can get a prettier diagram. I do not mean to say that this is conclusive against jackets, because it is quite consistent with this statement that the speed of the vessel might be a shade more with the jackets under steam. The boilers, however, might not be sufficient to maintain the intended steam pressure with the jackets on, and that having to be logged, the engineer would be blamed for not keeping up the pressure, and to escape blame he shuts steam off the jacket. One type of engine illustrated, that with the first cylinder tandem above the second cylinder, offers facility for greatly extending the life of the boilers. The top cylinder could be removed and the engines worked at 60 lb. pressure. Boilers made for 120 lb. might at the end of thirty years, if kept in repair, be still sufficient for 60 lb.

MR. RAVENHILL: I would like to ask Mr. Kirk one question; it would be very interesting if he could answer it, and that is, the relative weight of the machinery in water of the s.s. *Aberdeen* compared to one of the ordinary form of compound engine, of which he has made many, and where he has had a similar speed?

(*To be Continued.*)

STEAMSHIP PERFORMANCE.*

BY JOHN W. NYSTROM.

THE valuable article written by Chief Engineer Isherwood on the performance of the U. S. steamer *Dispatch*, and published in this Journal, encouraged me to write a similar article to show that the performance of a steamer can be determined beforehand when the drawings of the vessel and machinery are being made.

The various properties of any form and size of a vessel can be treated with correctness by the aid of the parabolic method of constructing ships, and it is here proposed to apply and exemplify that method on the data given by Chief Engineer Isherwood for the *Dispatch*, for the purpose of comparison, and to render the subject more intelligible.

The principal dimensions of the *Dispatch* are as follows:

$L = 174$ feet, length of the vessel.
$B = 25{\cdot}5$ feet, extreme breadth.
$d = 12$ feet, mean draught of water.
$\mathrm{x} = 186{\cdot}58$ square feet, area of the greatest cross-section of displacement.
$\mathbf{a} = 3163{\cdot}34$ square feet, area of the load water line.
$D = 19328{\cdot}64$ cubic feet, displacement at 12 feet draught.
$0{\cdot}7138$ = ratio of x to the surrounding parallelogram.
$0{\cdot}7129$ = ratio of **a** to the surrounding parallelogram.
$0{\cdot}5945$ = ratio of D to x L.
$0{\cdot}4250$ = ratio of D to the surrounding parallelopipedon.

From these data we find that the exponent for x is $n = 2\frac{1}{2}$, which corresponding cross-section is illustrated on Plate VIII., Nystrom's Pocket Book, and the ordinates for that section are obtained from Table I., page 450, where the correct ratio 0·7142 is found in column **a** x D, opposite the exponent $n = 2\frac{1}{2}$.

The exponent for the displacement is $n = 2\frac{1}{2}$, and power $q = 2$, which make the ratio for $D = 0{\cdot}7138 \times 0{\cdot}5952 = 0{\cdot}4248$ which Chief Engineer Isherwood says is 0·4250.

The number 0·5952 is the ratio of D to x L, and found in column **a** x D, Table V, page 451, opposite the exponent $n = 2\frac{1}{2}$.

Chief Engineer Isherwood says this ratio is 0·5945.

The centre of gravity of the displacement under the load wate line is given to be 7·345 feet, which is evidently wrong, but which can be corrected by formula 4, page 449, N. P. B., namely, as follows:

$$e = \frac{12}{2\left(2 - \dfrac{19328{\cdot}64}{3163{\cdot}34 \times 12}\right)} = 4{\cdot}0246 \text{ feet, instead of } 7{\cdot}345 \text{ feet.}$$

This formula does not include the displacement of the keels, which lowers the centre of gravity about half an inch in that form and size of displacement.

It now remains to determine the performance of the vessel in motion, that is, the resistance in water, which is equal to the thrust of the propeller, and found by formula 16, page 449, N. P. B. For this formula, it is necessary to find the mean angle of resistance and wet area of the displacement, namely, as follows:

Suppose the section x is located at $l' = 109$ ft. from the stem, and $l = 65$ ft. from the sternpost, then the mean angles of entrance in the bow and delivery in the stern are found by the formulas 17 and 18, page 449, N. P. B., for which the factor t is found in the column *Res. t*, opposite the exponent of the displacement in the tables. In the case before us we have given the exponent of the displacement $n = 2{\cdot}5$, and power $q = 2$, by which we find the tangent $t = 1{\cdot}355$, Table V, page 451.

During the trial, Jan. 14, 1889, the *Dispatch* drew $d = 12{\cdot}2$ ft. making the cross-section $\mathrm{x} = 195{\cdot}55$, including the sections of the two bilge keels, 4·8 square ft. The cross-section for determining the mean angle of resistance, and wet area of the hull, will then be $\mathrm{x} = 195{\cdot}55 - 4{\cdot}8 = 190{\cdot}35$ square ft. The area of the load water line during the trial was $\mathbf{a} = 3{,}180$ square ft.

Now we have all the data necessary for calculating the mean angle of resistance, namely as follows:

Formula 17, page 449. $\mathrm{Tan.}v = \dfrac{190{\cdot}35 \times 1{\cdot}335}{109 \times 12{\cdot}2} = 0{\cdot}1911.$

Mean angle of resistance, 10° 50′. $\mathrm{Sin.}v = 0{\cdot}18795$. $\sqrt{0{\cdot}18795^3} = 0{\cdot}081483$.

Formula 18, page 449. $\mathrm{Tan.}V = \dfrac{190{\cdot}35 \times 1{\cdot}335}{65 \times 12{\cdot}2} = 0{\cdot}32045.$

Mean angle of delivery, 17° 46′. $\mathrm{Sin.}V = 0{\cdot}30514$. $\sqrt{0{\cdot}30514^3} = 0{\cdot}16856$.

The fractions 0·081483 and 0·16856 are the radicals in the formula 16, page 449, namely, as follows: Resistance

$$R = 2{\cdot}858\, M^2 \left[\mathrm{x}\left(0.9\sqrt{\sin.^3 v.} + 0.1\sqrt{\sin.^3 V}\right) + \frac{A\ k}{\sqrt[4]{L}}\right]$$

M = nautical miles per hour, A = wet area of displacement and k = friction coefficient, to be found on page 448, for different conditions of the hull or wet surface of the vessel.

The wet area of the displacement is found by the formula,

$$A = [\mathbf{a} + 2(\mathrm{x} + d\,L)]\sqrt{\frac{D}{BLd}}$$

The factor under the radical is the ratio 0·4248 of the displacement, and the wet area will be as follows.

$A = [3180 + 2(190{\cdot}35 + 12{\cdot}2 \times 174)]\sqrt{0{\cdot}4248} = 5087{\cdot}9$ square feet.

This wet area includes only a part of that of the central keel, but not that of the bilge keels, which Chief Engineer Isherwood says are 416 square feet, to which add 96 square feet for the remainder of the central keel, makes the friction area $A = 5600$ square feet.

The hull of the *Dispatch* was coppered, for which the coefficient of friction is 0·0045. See page 448, N. P. B.

The speed of the vessel on trial was $M = 10{\cdot}75$ nautical miles per hour. Now we have all the data necessary for finding the resistance of the vessel by the above formulu 16.

$$R = 2{\cdot}858\, M^2 \left[195{\cdot}55\left(0{\cdot}9 \times 0{\cdot}081483 + 0{\cdot}1 \times 0{\cdot}16856\right) + \frac{5600 \times 0{\cdot}0045}{\sqrt[4]{174}}\right] = 8117{\cdot}1 \text{ pounds.}$$

That is, the thrust of the propeller should be 8117·1 pounds. Chief Engineer Isherwood makes the resistance 8146·33 pounds, or only 29·23 pounds more than by my formula. I am convinced that the formula gives the true resistance if supplied with correct data.

The term $\mathrm{x}\,(0{\cdot}9\sqrt{\sin.^3 v} + 0{\cdot}1\sqrt{\sin.^3 V})$ represents the resistance to the vessel in motion, which in the case before us is

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*From the Journal of the Franklin Institute.

17·637, of which $0{\cdot}9\sqrt{\sin.^{2}v}$ represents the forebody and $0{\cdot}1\sqrt{\sin.^{3}V}$ the after body of the displacement. The second term $\frac{A\ k}{4\sqrt{L}}$, represents the friction of the wet surface, which in this case is 6·94. The sum of these terms is 24·577, which represents the total resistance. That is, the resistance in displacing the water while the vessel is in motion is 71·762 per cent., and the friction 28·238 per cent. of the gross resistance.

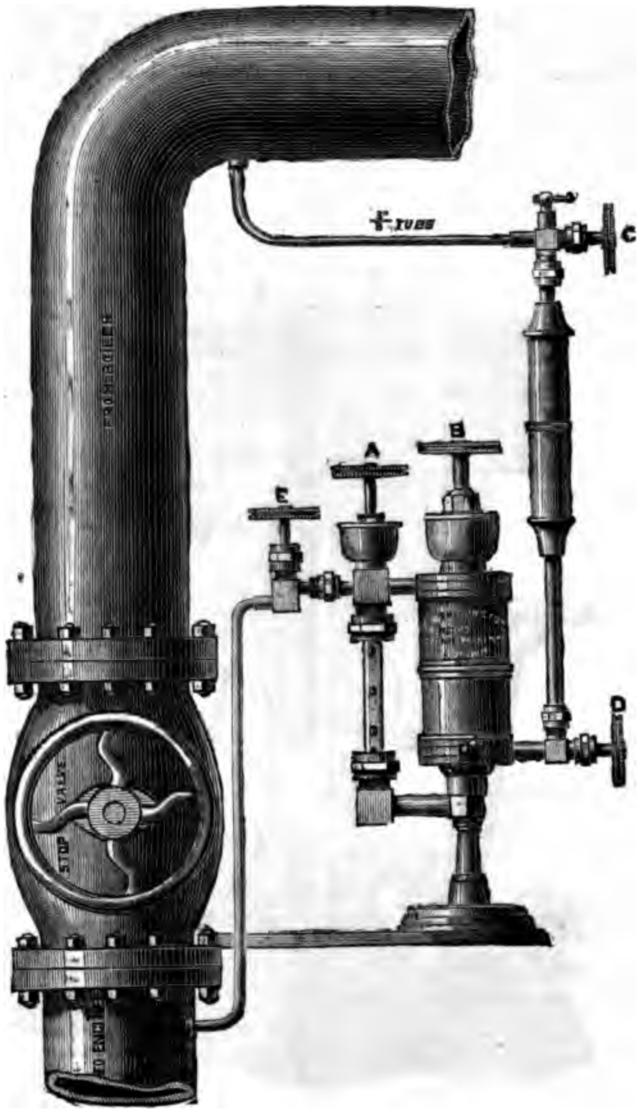
For fuller vessels, the resistance in displacing the water will be much greater in proportion to the friction, but if the vessel is fouled with barnacles the friction may become much greater than the resistance in displacing the water; all of which can be determined by the formula 16 for any form and size of the vessel.

(*To be continued.*)

Torpedo Boats for Roumania.—A few days since the steamer *Polam* left London for Galatz with two torpedo boats on her deck, which were constructed by Messrs. Yarrow & Co., of Poplar, for the Roumanian Government for service on the Danube. These torpedo boats are of the size usually termed second class, and attained a speed, on the official trial, of 16¼ knots.

SELF-ACTING LUBRICATOR.

MANY kinds of lubricants are to be found in the market the numbers of which prove the fact that there exists a great demand for good lubricants wherever engines are used. These lubricants are applied for the purpose of effecting a great saving in wear and tear and in friction.



To effect this in the most thorough manner it is necessary that the lubricant should be applied regularly and only in the required quantities. For this purpose Mr. John Etherington, of King William Street, London, has introduced an improved lubricator for feeding the lubricant to steam cylinders and valves for which he claims, in the first place, great economy, and in the second place correctness of feeding. This apparatus is arranged so that the working of the lubricant is visible in the gauge glass, and is fed in such a manner that it can be regulated instantly.

By this system all waste of oil is prevented, as it is fed into the cylinders or steam pipes drop by drop, so that it performs its work on the surfaces instead of being carried through the exhaust parts, also condensers and hot wells, thence to the boilers resulting in a large amount of waste. This lubricator does not require to be disconnected or taken apart, and is greatly appreciated for its efficiency and economy.

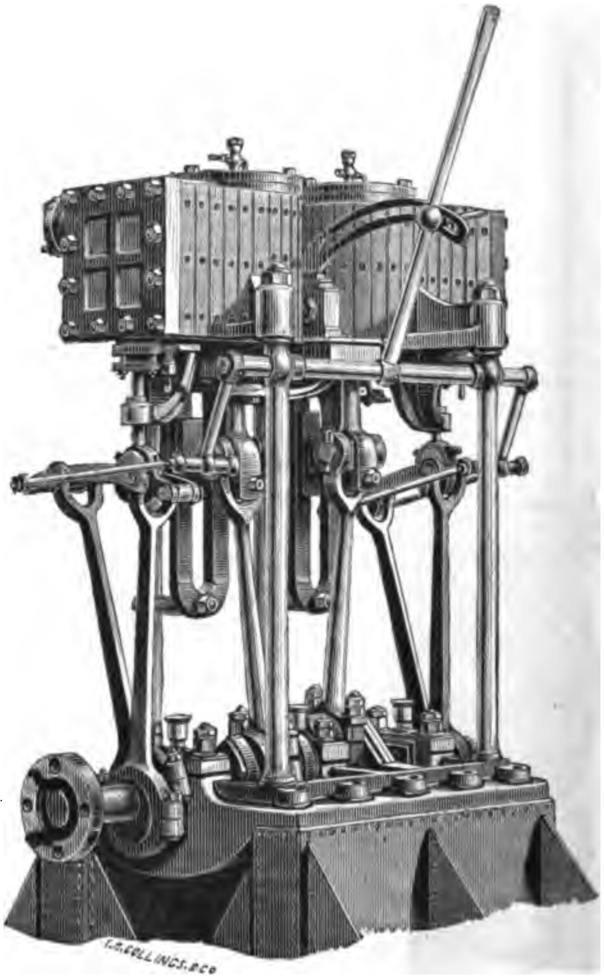
The accompanying illustration will show the action of the lubricator.

To fill this the mode of operation is to slack back the valve (A) a little, then fill the gauge glass with clear water, screw down again, then slack back the valve (B) a little, fill the lubricator with oil, screw down again, put the water pressure on a little by partly opening the valve (C) then slightly open the valve (D), and wait until the drops of oil ascend the glass, after this regulate the feed to the number of drops per minute or stroke of the engine, by valves D) and (E).

THE Admiralty have given an order to Mr. J. Samuel White, of East Cowes, for the supply of six of his 55 ft. "turnabout" boats to the Navy. These small craft possess marvellous turning powers, either going ahead or astern, and have realized a speed of 14 and a half knots on the measured mile.

J. WIGZELL'S NEWLY-DESIGNED YACHT ENGINE.

THE ever-increasing numbers of yachts and yacht-owners, and the development of steam propulsion, as well as the steps now being taken by the sporting body of yachtsmen to class steam yachts for racing, has induced marine engineers to study the improvement of engines so as to adapt them to every requirement for pure yachting purposes.



J. WIGZELL'S YACHT ENGINE.

We have had many inventors in the field who have, in most instances, brought out many valuable additions to the general efficiency of this special machinery, and as the demand for this speciality increases the endeavours to improve on foregoing arrangements are displayed. It is an old acknowledged fact, not only applicable to yachts but to all classes of vessels, that the great object aimed at in the improvement of marine engines, is to obtain the greatest amount of power possible from the machinery of the lightest efficient construction.

This factor, viz., that of low weight for power, is particularly sought for by yachtsmen, and in this direction we notice that Mr. G. E. Wigzell, of 37, Walbrook, E.C., has succeeded in constructing a newly-designed steam yacht engine of singularly light construction. The illustration we give will convey some idea of its compactness and general handy qualities. The cylinders, which are very small and neat, are supported by four steel columns, and the inventor has arranged the two back columns so that they are directly opposite the crank, which the guide plates are connected to, and are made of phosphor bronze. It will also be apparent that every part of the engine is of the simplest but most effective description, and at the same time open to the easiest access in every part.

All the parts that are in motion are made of steel. The pistons are fitted with Wigzell & Pollit's Patent Metallic Piston Coils. As will be seen from the illustration, the link motion is of special design. All the working parts are made adjustable. The connected rod bearings and crank shaft bearings are made of phosphor bronze on account of this being the finest metal for the high speed this engine is capable of producing. Another feature to be noticed is, that the lubrication of the working parts is supplied from one lubricator which is placed on the front of the cylinders. We would add that a condenser and air pump can be connected to this type of engine.

TECHNICAL EDUCATION IN NAVAL ARCHITECTURE.

On November 20th. W. John, Esq., general manager of the Barrow Shipbuilding Company, read a paper on the above subject at the Barrow Island Reading Room and Library. There was a large attendance owing, no doubt, to the importance of the subject to be dealt with. In the absence of Councillor Little, Mr. J. P. Wilson was voted to the chair. The Chairman, in a brief speech, introduced the Lecturer to the meeting.

Mr. John, who was received with applause, said :—

The subject of this lecture, is I think, one that cannot fail to be of some interest in this institution. Situated as we are in a town largely supported by shipbuilding—our Library even within the boundary of a large shipbuilding establishment—and most of our members being engaged in some branch of shipbuilding or marine engineering; and being all of us deeply interested in education, both techical and otherwise, I am persuaded you will join with me in an endeavour to look at the subject I am about to bring before you with critical intelligence, and with a desire to see if any practical good can be extracted from it.

We have heard and read a great deal of late years about Technical Education, and about the necessity for a greater spread of it in this country, if we are to hold our own in manufacturing and other competitions with Americans and the more enlightened continental nations. There doubtless was much truth in the fear which crept over this country after the Great Exhibition of 1851, that we were sadly lagging behind in many respects, and for which this was the only cure: and every one must look with interest at the steps—important steps—that are at last being taken in various directions to promote technical schools and universities.

Shipbuilding, however, stands in a somewhat peculiar position among trades, and is perhaps too isolated for its members to benefit much by these great general movements, and this makes it the more necessary for us to look to our resources to foster organisations for affording the best training to those who enter, as a profession, upon the career of a shipbuilder. In some parts of the country this is being attended to in a way that is highly praiseworthy. In others parts of the country, where shipbuilding is carried on even on a larger scale than at Barrow, it is almost entirely neglected.

I fear we have not made much progress in Barrow. If any of you present, engaged as you are in shipbuilding and engineering—and perhaps fond of it, as I hope you all are—desired to bring up a son to the profession, and see him rise in his profession, you would, I fear, be rather puzzled to know how to go about it, and where to get him trained. He might have a facility for the business and be ever so industrious; but without a pretty sound training in early life it is an up-hill struggle in after life to master the intricate principles which underlie and surround naval architecture.

I hope to show you before I have done that it is not impracticable to very materially improve this state of things in a town where we have undoubtedly one of the finest, if not the finest, mercantile shipbuilding yard in the country; another one rapidly assuming important proportions, and the possibility of others still to come. Before dealing with this, however, I may perhaps be allowed to digress a little, and to offer a few general remarks on the subject.

If any body of men have just cause to feel a tinge of vanity, or rather pride, in their calling, and in the fruits of their labour, I think the shipbuilders have. If we look at the magnitude of the operations of building, launching, engineing, and completing a modern passenger ship of the first rank, and regard the completeness of the arrangements and beauty of finish now expected, and then think this structure has to brave the elements, make regular passages, convey thousands of human souls and ten thousands of tons of merchandise every year across the ocean, we cannot but feel that we are occupied in useful human labour.

Men in all walks of life, I do not doubt, ask themselves the question whether they are really doing useful work in the world? and gain internal satisfaction or otherwise from the answer they are able to give themselves, quite apart from the question of wordly gain. There can be no doubt of the answer in a shipbuilder's mind—that is, if he builds good ships. But more than this, there is a public sentiment which surrounds ships that no other mechanical structures can command. The glamour that attaches to the sea, seamen, and ships, in the minds of people living in inland towns is easily observable; and any one acquainted with the landing-stage at Liverpool, the London Docks, and other points of arrival and departure of shipping, knows that ships are talked about and their merits discussed, in the tone, and with the interest that usually associates itself with animate rather than inanimate objects. Beautiful churches, grand buildings, huge structures of all kinds, have a certain interest pertaining to them, but it is different in kind from that which surrounds a ship. The one is fixed, immoveable, inert: the other here to-day and gone to-morrow, building up a history from day to day, with a reputation as sensitive as a woman's to calumny, and like her, consequently, often a bone of contention as well as an object of admiration.

On these grounds, therefore, I should contend that a shipbuilder's life, unlike the policeman's in the "Pirates of Penzance," should "be a happy one." It not always is though, I am free to confess, and even with men who have devoted a lifetime to the careful and intelligent study of it. What it must be to those who have pursued it in a desultory, rule-of-thumb manner, I cannot conceive. I know there are points connected with naval architecture that the best men in the profession have misgivings about, that the ablest mathematicians have failed as yet to reach the elementary theory of, which, on the other hand, people uninformed dogmatise upon with the utmost confidence. This is the most fertile source of blunders in connection with ships. So long as one ship follows another with but little change there is not much chance of going wrong. It is when new departures have to be made that a sound knowledge of the principles which govern the matter is of invaluable assistance in keeping out serious error, even if the data is not sufficient to ensure going right with perfect accuracy. And before going from this part of my paper, I should like to say that I do not know any one subject which is so rife with amusing fallacies as about every feature connected with the behaviour of ships. The fallacies that have been promulgated in relation to their strength, their stability, their behaviour at sea, and their speeds, would fill a volume, and some of them exist to the present day. Many of them have been scotched within the last twenty years; but all fallacies connected with shipping die very hard. The fact is that the laws which govern wave motion at sea, and the laws which govern the resistance of ships in motion were practically unknown till within that period. Chiefly owing to the patient untiring genius of the late Mr. Froude, and next to him Professor Rankine, naval architects have now some sound light to guide them; but there is much investigation still to be done before anyone can count with absolute certainty upon distinctly novel new designs. Within ordinary limits novelties can be provided for with tolerable success

(*To be continued.*)

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed.]

LAUNCHES.—English.

Kalmia.—On the 15th Nov. Messrs. W. H. Potter & Son launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, an iron sailing vessel of the following dimensions, viz.:—Length, 270 ft.; breadth, 39 ft.; depth in hold, 24 ft.; tonnage, B.M., 1,995 tons; tonnage, nett register, 1,800 tons; deadweight capacity, 2,950 tons. As the vessel left the ways she was christened the *Kalmia* by Mr. S. H. Sandbach. The *Kalmia* has been built to the order of Messrs. Sandbach, Tinne & Co., of Liverpool, and is the fourth vessel built for them by Messrs. Potter. She takes the highest class at Lloyd's and the Liverpool underwriters, her scantling being in excess of the requirements of both books, and she is fitted with iron poop, iron deckhouses, and all the most recent improvements.

Biscaye.—On Nov. 22nd, there was launched from the iron shipbuilding yard of Messrs. John Blumer & Co., North Dock, Sunderland, this iron screw steamer, built to the order of Messrs. Delmas Forreo La Rochelle. The dimensions are 250 ft. in length, by 38 ft. in breadth, and 19 ft. in depth; deadweight carrying capacity, 2,240 tons on a mean draught of 17 ft. 6 in. She has a patent windlass by Messrs. Emerson, Walker & Co., London. Her engines will be fitted by Messrs. Thomas Clark & Co., of Elswick-on-Tyne, and will be of 150-horse power. The estimated speed is 9 knots.

Lady Ann.—On the 22nd Nov. there was launched from the yard of Messrs. S. P. Austin & Son, Wear Dockyard, Sunderland, a new iron screw steamer of the following dimensions:—Length over all 233 ft.; extreme breadth. 33 ft.; depth of hold, 16 ft. 3 in. She has been built under special survey for the Liverpool Underwriters' classification, and is constructed with long raised quarter-deck, topgallant forecastle, iron decks, rails, and double bottom for water ballast. She will be fitted with compound surface condensing engines of 110-horse power nominal, patent windlass by Emerson, Walker & Co., and three steam winches. The vessel is the third built in this yard to the order of H. T. Morton, Esq., of Biddick Hall. As she left the ways the vessel was named the *Lady Ann*, the ceremony being gracefully performed by Miss Sybil M. Austin.

Glengoil.—On the 25th Nov., Messrs. Joseph L. Thompson & Sons, shipbuilders, Sunderland, launched an awning-decked steamer to the order of Messrs. Lindsay, Gracie & Co., Newcastle-on-Tyne. Her dimensions are 330 ft. extreme length, 40 ft. beam, and 29 ft. depth to awning-deck, and she is expected to carry about 5,500 tons measurement cargo. She was named the *Glengoil.*

Aberdare.—On the 25th Nov. there was launched from the Howdon yard of Palmer's Shipbuilding & Iron Company (Limited) the screw steamer *Aberdare*, built for Messrs. Morel Brothers & Co., Cardiff. The *Aberdare's* dimensions are:—Length, 250 ft.; breadth, 33 ft.; depth, 18 ft. Her engines, also by Palmer's Company, will be 130-horse power. She is fitted with the most modern improvements including Emerson, Walker & Co.'s windlass.

Prince Llewellyn.—On the 25th Nov. the screw steamer *Prince Llewellyn* was launched at the Jarrow-on-Tyne yard of Messrs. Palmer's Shipbuilding and Iron Company. She has been built to the order of the Cardiff house of Messrs. J. and R. Bovey, of London, Cardiff, and Newport, and will be registered at Cardiff. The next steamer for the Cardiff house is the *Gelert*, which Palmer's Company expect to launch in January.

Hartburn.—On the 25th Nov., Messrs. Edward Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer, built to the order of Messrs. R. Ropner & Co., West Hartlepool. Her principal dimensions are:—Length between perpendiculars, 275 ft.; beam extreme, 35 ft. 6 in.; depth, moulded, 21 ft. 2 in.. She has been built to Lloyd's highest class, and has short poop, long quarter deck, and charthouse, with topgallant forecastle extended over forehatch and to the foremast. She has water ballast under each hold, and her decks, masts, charthouse, engine skylight, and cabin companion are of iron. She will be fitted with four hatches and steam winches, two donkey boilers, patent windlass, and will be rigged as a double-topsail schooner. Engines of 200 nominal horse power will be supplied by Messrs. R. & W. Hawthorn, of Newcastle-on-Tyne. This vessel is No. 114 in the builders' yard, and the fourth built by them for the same owners. On leaving the way the steamer was christened *Hartburn*, by Miss Field, of Preston.

Carina.—On the 27th Nov., Messrs. M. Pearce & Co. launched from their iron shipbuilding yard at Stockton an iron steamer of the following dimensions, viz.:—Length between perpendiculars, 257 feet 6 in.; breadth extreme, 34 ft. 6 in.; depth 20 ft. 4½ in.; about 1,680 tons gross register, and classed 100 A 1 at Lloyd's. Her engines will be of 160-horse power nominal, by Messrs. Blair & Co. As she left the ways the name of *Carina* was given to her by Mrs. H. Cloake, junr. This the third steamer Messrs. M. Pearce & Co. have built for H. Cloake, Esq., of Cardiff, and they have another building.

Oread.—Messrs. T. Royden & Sons launched from their shipbuilding-yard, November 27th, the barque *Oread*, for Mr. James Newton, of the Liverpool Screw Towing and Lighterage Co., 11, Nova Scotia. This vessel is intended for the West Coast Trade, and on leaving the ways was gracefully christened by Miss S. E. Maxwell Newton, daughter of the owner. She will be commanded by Captain James Anderson, late of the barque *Roscote.* Her dimensions are:—Length 185 ft.; beam, 31 ft. 9 in.; hold 19 ft. 5 in.; tonnage 890.

Kron Prinz.—On the 28th Nov. Messrs. Short Brothers, launched from their shipbuilding-yard at Pallion, Sunderland, a screw steamer, built to the order of Messrs. J. H. Lorentzen & Co., of Hamburg, and under the personal supervision of Mr. Rudolph Lorentzen, the representative of the firm in this country. The following are the principal dimensions and particulars of the steamer:—Length 260 ft.; breadth, 38 ft.; and 21 ft. 6 in. deep to top of keel, with a dead-weight carrying capacity of 2,550 tons. She is constructed to the A 1 Class Red, under special survey in the Liverpool Underwriters' Registry, with short full poop for accommodation of Captain and officers; long raised quarter deck with a large house for accommodation of engineers; bridge house over engines and boilers, and topgallant forecastle, all the decks being of iron except poop. She is divided into four cargo compartments, with a large hatchway and powerful steam winch to each; water ballast, all fore and aft, on the longitudinal principle, divided into separate compartments for trimming the ship, and all the latest improvements for loading and discharging. The winches and boilers are supplied by Messrs. Clarke, Chapman, & Gurney, and the windlass by Messrs. Harfield & Co. On leaving the ways, the vessel was named *Kron Prinz*, the ceremony of christening being performed by Mr. F. Meier, of Sunderland. She is to be fitted with engines and boiler of 160-horse power by Messrs. Thomas Richardson & Son, of Hartlepool, with all their latest improvements in marine engineering. This is the 13th vessel launched by Messrs. Short this year.

Mapocho.—On the 28th Nov. Messrs. Laird. Brothers, launched from their works at Birkenhead, a screw steamship, named the *Mapocho*, built to the order of the Compania Sud Americana de Vapores, through their London representatives, Messrs. B. F. Smith & Co. The new steamer, which is intended for the company's service on the West Coast of South America, is very similar to the *Cachapoal*, built by Messrs. Laird for the same owners during last year, and which has proved herself one of the fastest and most successful vessels on the coast. To meet the special requirerequirements of the trade, and secure perfect ventilation, the sides between main and spar decks have been left open, the spar deck being supported on stanchions, and the whole of the accommodation for first-class passengers and officers provided in spacious deck houses on that deck, under cover of the shade deck, which will afford a magnificent promenade the whole length and width of the ship, and be protected by canvas awnings. There will be accommodation for about 160 first-class passengers in a saloon the full width of the deckhouse; a number of third-class passengers will be provided for on the main deck, and there will be a space for a large number of cattle. The *Mapocho* will be rigged with three pole masts. She is fitted for water ballast, and will be provided with steam windlass, steam steering-gear, five steam winches, and a steam launch; also with electric-lighting apparatus, and all the latest and most approved appliances as a first-class passenger steamer. Her dimensions are:—Length, 320 feet; beam, 41 feet: depth of hold, 23 ft. 6 in.; tonnage O.M., 2,641 tons; and she will be fitted with a set of Messrs. Laird's direct-acting inverted compound engines, having cylinders 45 and 80 inches in diameter, and 4 ft. 6 in. stroke, supplied with steam at 90 lbs. pressure from four cylindrical boilers, and calculated to develop about 2,400-horse power, and to drive her at a very high speed. The *Mapocho* was christened by Mr. Hammond.

Cairo.—On November 29th, a steel screw steamer, named the *Cairo*, built for Messrs. Thos. Wilson, Sons & Co., of Hull, was launched from the yard of Earle's Shipbuilding and Engineering Company (Limited), Hull. This steamer is a sister ship to the *Kovno*, *Grodno*, and *Draco*, which have recently been built by Earle's Company for the same owners. She is intended for the Baltic and Mediterranean service. Her dimensions are :—270 ft. between perpendiculars, 34 ft. beam, and 18 ft. 3 in. depth of hold; and she has been constructed to class A1 in the Liverpool Registry. Her gross tonnage will be about 1,800, and her deadweight carrying capacity 2,350 tons. The engines, which also have been made by Earle's Company, are 140 nominal horse power, having cylinders 25 in. and 50 in. diameter by 45 in. stroke.

Dolphin.—On December 9th, there was launched H.M.S. *Dolphin*, first of two similar vessels building by Messrs. Raylton Dixon & Co, for H.M. Navy, under the superintendence of Mr. J. G. Allen, Admiralty overseer, assisted by Mr. Adam. Displacement 1000 tons, engines of 750 horse-power armament, two 6 in. breechloading guns placed in forecastle, and poop for chase guns and two broadside breech-loaders of 5 in. bore, one 7-pounder boat-gun, and two Gardner guns, which are somewhat similar to the well known Gatling guns. This vessel is very similar to H.M S. *Condor*, which did such excellent service under Lord Charles Beresford at the bombardment of Alexandria, where she, a small armoured gun vessel, silenced and took the Marabout Forts. Built on composite principle, thus, she has iron frames, steel bulkheads and flats, and the shell consists of two thicknesses of teak, 3 inches each, copper fastened and screw bolted to the frames, stem and keel of English oak, bottom covered with copper up to water line; lining of poop, cabins and all the bulwarks are of thin steel plates instead of wood, to prevent splinters. Horizontal engines of 750 indicated horse-power, are made by Messrs. R. and W. Hawthorn, and will be put on board at Middlesbro' Dock. They were exhibited complete at the recent Tynemouth Exhibition, where they were much admired. The Regulation Service used at the launching of all Her Majesty's ships, was read by the Rev. J. K. Bealey, Vicar of Middlesbro' and the launching ceremony was performed by Mrs. Raylton Dixon, wife of the builder, who using a pair of silver gilt scissors, specially made for the purpose of a design, appropriate to the name, severed a ribbon which released the weights over the "dog shores," thus setting the vessel in motion, and at the same time broke the bottle of wine on her stern, christening her the *Dolphin*. As the vessel glided off the ways, the band of the North York Artillery struck up "Rule Britannia." This is the seventeenth vessel launched by Messrs. Dixon this year. Another large steamer will be launched next tides, and H.M.S. *Wanderer* in about six weeks time. They have now in hand building and to lay down 19 steamers, mostly of large size, some of them being over 4,000 tons.

Castanos.—On December 9th, Messrs. Oswald, Mordaunt & Co. launched from their shipbuilding and engineering works, Southampton, a screw steamer of 1,700 tons, named the *Castanos*, built to the order of Messrs. Morel Brothers, Cardiff, of the following dimensions, viz. :—Length between perpendiculars, 260 ft.; breadth, 36 ft.; depth of hold, 18 ft. The vessel is built with raised quarter deck bridge, full forecastle, and double bottom for water ballast. The ship and èngines are to take the highest class at Lloyd's. The engines, by the same firm, are on the compound principle, having cylinders 30 in. and 60 in. diameter, and a stroke of 42 in., steam being supplied by two boilers, 13 in. diameter, with a working pressure of 90lbs. The ceremony of naming the vessel was performed by Miss Kemp, daughter of the captain. During the course of construction the vessel has been inspected by Mr. Phillips. This ship is No. 201 in the builders' books, and makes up a gross tonnage of 22,000 tons launched this year.

Veronica.—On the 9th Dec. a steamer was launched from Messrs. Charles Hill & Sons', Albion Dockyard, Bristol. Dimensions :—120 ft. long, 23 ft. beam, 11 ft. deep, and about 250 tons gross register. She is classed 100 A 1 at Lloyd's, is fitted with water ballast, steam winches, and all modern appliances. Engines 45-horse power nominal, direct acting compound surface-condensing, by Plenty & Son, of Newbury. She is intended for the coasting trade, and is built to the order of Messrs. Cuthbert, Hancock & Co., of Cardiff, and is the third vessel built for them by Messrs. Charles Hill & Sons. As she left the ways she was christened the *Veronica* by Miss Mary Tomlinson, daughter of Captain Tomlinson, dockmaster.

Sacrobasco.—On the 11th Dec. Messrs. Bartram, Haswell & Co. launched from their shipbuilding yard at the South Dock, Sunderland, an iron screw steamer for Messrs. Wilkie & Turnbull, of North Shields. The following are the principal dimensions :—Length over all, 315 ft.; breadth, 37 ft.; depth of hold, 24 ft. 6 in.; carrying capacity, 3,350 tons. She has been built under special survey to take the highest class both at Lloyd's and the Liverpool Underwriters' Association, and also under the personal superintendence of the owners. She is flush-decked, and has two iron decks, the upper one being covered with wood. There is a large poop aft fitted up for the captain, officers, and a few passengers, a long bridge amidships protecting the engine and boiler openings, and a commodious topgallant forecastle forward for the crew. She has Amos & Smith's hand and steam steering-gear amidships, Emerson Walker's patent windlass, a patent convector donkey boiler made by Joseph Adamson & Co., of Manchester, and five large steam winches supplied by James Taylor & Co., Birkenhead. There are iron shifting-boards fitted in the lower hold to prevent the shifting of grain in bulk, and the whole of the deck arrangements are well planned for economic working and quick despatch. The engines, of 220-horse power, will be fitted by Mr. John Dickinson, of Palmer's Hill, Engine Works. As the vessel left the stocks she was named the *Sacrobasco* by Miss Bartram, daughter of one of the builders.

Cairo.—On the 11th Dec. a steamer was launched from Whitehall Shipyard, Whitby, to be added to Messrs. T. Turnbull & Co.'s fleet. The new steamer was christened the *Cairo* by Miss J. V. Turnbull, as proxy for Mrs. Joseph Tindall. The dimensions of the new steamer are as follows :—Length, 260 ft.; breadth 37 ft.; depth of hold, 18 ft 6 in.; carrying capacity, 2,400 tons; engines by Blair & Co. of Stockton, 140-horse power.

ON December 12th there was launched from the yard of James Laing, Esq., of Deptford, (Sunderland), for the Compagnie Havraise Peninsulaire de Navigation à Vapeur, Havre, a spar decked screw steamer of the following dimensions :—285 by 38 by 27·6, class 100 A 1, and highest in Veritas. The vessel is constructed with bridge-house, monkey forecastle, and hood aft, steam quartermaster, Emerson, Walker & Co.'s patent horizontal direct acting windlass, water ballast in both holds, and has been built under the superintendence of Captain Moutier. She will be fitted with engines by G. Clark, Esq., Southwick, of 200-horse power. The christening ceremony was performed by Madame Brault, of Sunderland.

Castlegate.—On December 12th, Messrs. Hodgson & Soulsby launched from their shipbuilding-yard at Blyth, an iron steamer of the following dimensions :—Length, 265 ft.; breadth, 36 ft.; depth, 23 ft.; classed 100 A at Lloyd's, and about 2,700 tons burthen. The engines, 200-horse power, are to be supplied by Messrs. Blair & Co., (Limited), of Stockton-on-Tees. She has been built for the Castle Line of Liverpool steamers to the order of Messrs. Thomlinson, Thomson, & Co., Liverpool. The christening ceremony was performed by the Hon. Mrs. Carr, sister of Viscount Molesworth, one of the shareholders.

Esk.—There was launched at Barrow, on December 12th, a schooner-rigged iron steamer named the *Esk*. Her tonnage is 2144·53 gross register; length, 309·5 ft.; breadth, 36·2 ft.; and depth, 16·7. Her engines are 350-horse power nominal; 38 and 74 in. diameter of cylinder and 54 in. stroke. She has been built to the order of the Royal Mail Steam Packet Company, London, by the Barrow Ship Building Company.

Ville de Tarragone.—On Dec. 12, there was launched from the shipbuilding yard of Messrs. Robert Thompson & Sons, Southwick, Sunderland, an iron screw steamer, 240 ft. long, breadth 33½ ft., and 24¾ ft. depth in hold to spar deck, built for Cie. Havraise Peninsulaire de Navigation à Vapeur, Havre, under Lloyd's special survey for the highest class and French Veritas, also under the personal superintendence of Captain Moutier. She has cabin aft (with entrance to same from large smokehouse on spar deck aft, protected by hood covering on the stern), fitted up for the captain and passengers, and there is accommodation under the spar deck for the officers and engineers amidships, and forward for firemen and crew. The vessel has also monkey forecastle, large chart and wheelhouse under the bridge amidships, a lookout bridge forward; water ballast in both holds; four large hatchways; four large steam winches and donkey boiler by Messrs. Clark, Chapman and Gurney; Emerson, Walker & Co.'s patent windlass; Higginson & Co.'s patent steam quartermaster steering gear amidships; patent screw gear aft, &c., &c. She will be fitted with engines of 150-horse power, by Mr. George Clark, Southwick. As the vessel left the ways she was named the *Ville de Terragone* by Madame Brault, wife of the French Consul at Sunderland.

Eddlethorpe.—On December 14th, William Gray & Co. launched from their south yard at West Hartlepool, an iron steamer of the following dimensions :—Length, 256 ft. 6 in.; breadth, 34 ft. 6 in.; depth, 19 ft. 8 in. Class 100 A 1 at Lloyd's, built to the order of Messrs. C. S. Todd & Co., West Hartlepool, intended for general trade, to carry about 2,350 tons. She is fitted with double bottom for water ballast, long raised quarter-deck, and topgallant forecastle and bridge amidships. The engines, 150-horse power, are being made by Messrs. Black, Hawthorn & Co., Gateshead. On leaving the ways the christening ceremony was performed by Miss Bannister, of Easingwold, the vessel being named *Eddlethorpe.*

C. W. Eborall.—On December 14th, the iron twin screw steamer, *C. W. Eboroll*, which have been built by Earle's Shipbuilding and Engineering Company (Limited), of Hull, for the South Eastern Railway Campany's passengers and cargo service between Folkestone and Boulogne, was launched. This boat, which is a sister vessel to the steamships *Folkestone* and *Boulogne*, which also were built by Earle's Company, is a fore-and-aft schooner-rigged steamer, measuring 190 ft. between perpendiculars, 25 ft. beam, and 12 ft. depth of hold; her gross tonnage is about 410 tons, and she has been constructed under survey to class A 1 Channel service in Lloyd's Register. Her engines are 110 nominal horse power collective, each engine having two cylinders 20 in. and 39 in. diameter by 24 in. stroke. This is one of five steamers Earle's Company have in hand for English railway companies, as they are building two large steamers for the Manchester, Sheffield, and Lincolnshire Railway Company's Hamburg, and Rotterdam trade, and two large fast steamers for the Great Eastern Railway Company's passenger service between Harwich and Antwerp.

LAUNCHES.—SCOTCH.

Highland Glen.—There has been launched from the yard of Messrs. Ramage, Ferguson, and Leith, an iron sailing barque, of 1,000 tons nett register, built to the order of Messrs. Crane, Colvil, and Company, Glasgow, and intended for the Australian and East Indian trade. On leaving the ways she was named the *Highland Glen* by Miss Sillars, of Glasgow. The vessel is classed 100 A 1 at Lloyd's, is fitted up with all modern improvements, including Emerson, Walker, & Co.'s double purchase, capstan windlass now generally adopted for large sailing vessels, and from her fine lines she is expected to be a fast sailer. She will be commanded by Captain John S. Naile, of Cockermouth, who acted in the capacity of ship's husband during the building of the vessel.

Devonia.—On November 23, there was launched from the shipbuilding yard of Messrs. Murdoch & Murray, a steel screw steamer of the following dimensions:—140 by 21 by 10·3. She has been built to the order of Messrs. Dunsmuir & Jackson, Govan, who supply the engines.

Liverpool.—On the 25th Nov. there was launched from the shipbuilding yard of Messrs. Dobie & Co., Govan, Glasgow, a four-masted iron sailing ship, called the *Liverpool*, built to the order of Captain W. Price, of the firm of W. Price & Co., of Liverpool. Her dimensions are:—Length, 275 ft.; breadth, 42 ft.; depth, 24 ft.; her register is about 2,100 tons, and she will carry about 3,300 tons deadweight. This vessel has been built to class 100 A 1 at Lloyd's, also to the newly-amended rules, which came into force in Jan., 1882, and which provide for extra strengthening for this class and size of a ship, which has been found, from past experience, was much required. This is the largest iron sailing ship that has been built by Messrs. Dobie & Co. The christening ceremony of naming the ship was performed by Mrs. Foley, wife of Captain John G. Foley, who will command the vessel. She has been chartered to load at Glasgow for Buenos Ayres.

William Hope—On the 25th Nov. Messrs. Hamilton & Co. engineers and shipbuilders, Leith, launched from their shipbuilding-yard an iron screw steamer of about 140 tons, built to the order of Messrs. William Hope & Sons, merchants, Leith, for their general coasting trade. The vessel, which was named the *William Hope*, will be fitted with compound surface-condensing engines by the builders, this being the third steamer that they have built for Messrs. Hope.

Forth.—On the 25th Nov. a twin-screw hopper dredger, built and engined by Messrs. William Symons & Co., was launched complete from their works at Renfrew. This vessel is named the *Forth*, and is the property of Messrs. Lawson & Best, Glasgow; it will dredge to 30 ft. depth, and carry 800 tons of its own soil at a speed of seven knots per hour. It is intended for the deepening operations at Grangemouth, and is the second hopper dredger the builders have supplied to these works. It is fitted with two independent sets of compound engines of 400-horse power collectively, and steam appliances throughout.

Waihora.—On the 25th Nov. Messrs. William Denny & Co. launched from Leven Shipyard, Dumbarton, a steel screw steamer of 1,950 tons gross measurement, for the Union Steamship Company of New Zealand (Limited). On leaving the ways she was named the *Waihora* by Miss Brock, daughter of Mr. Walter Brock, Levenford House, Dumbarton. The dimensions of the *Waihora* are: Length between perpendiculars, 285 ft.; breadth, moulded, 36 ft.; depth, moulded 25 ft. She has been constructed of Siemens-Martin steel, under special survey of Lloyd's, and classed in their registry 100 A 1 three-decked. She is built on the continuous cellular bottom principle, with solid floors, and adapted for water ballast. Throughout the machinery space the structural system of deep plate frames and hold side stringers have been adopted. She will have accommodation for 124 first-class passengers on main and upper decks. The officers and engineers will be accommodated in the mid-ship side-house under bridge deck, and the firemen and crew will occupy the forecastle. The vessel will be fitted by Messrs. Denny & Co. with compound surface-condensing engines, having cylinders 38 in. and 68 in. in diameter, and the stroke of piston 45 in. While being constructed, the *Waihora* has been under the inspection of Mr. J. Darling, superintendent engineer of the company.

Balnacraig.—On the 25th Nov. there was launched from the building-yard of Messrs. Hall, Russell & Co., an iron screw steamer of the following dimensions:—Length, 255 ft.; breadth, 34 ft. 6 in.; depth, 26 ft., and 1,640 tons gross. This vessel has been built under special survey, and to class 100 A 1 at Lloyd's, and under the personal superintendence of Captain Davidson, the owner's representative. The vessel will be fitted with compound surface condensing engines, of 150-horse power nominal, steam winches, patent windlass, water ballast, and all the most approved appliances for facilitating the loading and discharging of cargoes. The vessel, which has been built to the order of Messrs. J. & A. Davidson, is the fourteenth vessel built by this firm to the order of the same owners. As the vessel left the ways she was named the *Balnacraig*, by Miss Davidson, daughter of one of the owners, and was afterwards taken to the shear poles for the purpose of receiving masts and machinery.

Imberhorne.—On the 28th Nov. Messrs. A. M'Millan & Son launched from their dockyard at Dumbarton an iron sailing ship registering nearly 2,100 tons, and named the *Imberhorne.* This ship is fitted with everything necessary for the most efficient and economical working of the ship and cargo. She has two powerful steam winches, which work the patent pumps, windlass, &c., and steam fire pump, capable of throwing a strong stream of water, which can be conveyed to any part of the ship. The main deck, petty officers' and crew's quarters, engine-room, and shaft ventilators amidships are covered and sheltered from heavy seas breaking on board by a bridge-house extending from the main hatch to near the foremost from side to side. This is a new feature for a sailing ship. The accommodation for captain and officers is in a short poop, on top of which is built a chart house for the convenience of the captain. A beautiful model of the *Imberhorne* and her sister the *Falconhurst*, now building in the same yard, was exhibited at the International Exhibition of Ship Models held in London last summer under the auspices of the Shipwrights' Company, and gained for Messrs. M'Millan for the second time the first prize and gold medal of the Guild. The *Imberhorne* was built under the superintendence of Captain Hugh M'Intyre, who has previously inspected the construction of several ships built by the same builders for the owners—Messrs. W. R. Price & Co., London. The ship was named by Captain M'Intyre's wife.

City of Madras.—On the 28th November, Messrs. Barclay, Curle & Co., launched from their shipbuilding yard, Whiteinch, Glasgow, an iron sailing ship for the East India trade of Messrs. George Smith & Sons, Glasgow. The dimensions of the vessel are 252 ft. by 38·4 ft. by 23 ft., and the tonnage 1,660 gross. On leaving the ways she was named the *City of Madras* by Mrs. Halley, wife of the commander.

Cintra.—On the 28th November, Messrs. Napier, Shanks, & Bell, Yoker, launched from their yard the second of a new fleet of steamers built to the order of the Australasian Steam Navigation Company of Sydney, New South Wales. The *Cintra*, which was the name given to the new vessel by Miss Russell, of Uddingston, is a vessel of 2,000 tons gross, 270 ft. long, 37 ft. broad, and 24 ft. deep. The passenger accommodation is on a most extended scale. When completed, the new ship will be able to carry seventy-two first, and eighty second and third-class passengers, besides a fair cargo of miscellaneous goods. All the latest improvements to ensure comfort and safety at sea, combined with Board of Trade and Lloyd's requirements, have been carefully studied. The engines, which are to be fitted into the new steamer by Messrs. John and James Thomson, are of the compound surface-condensing class, with two cylinders, and are expected to develop about thirteen knots an hour.

Brinio.—On the 29th November Messrs. Murdoch & Murray launched at Greenock an iron screw steamer of the following dimensions:—Length, 185 ft.; breadth of beam, 27 ft.; depth of hold, 14 ft. 2½ in.; about 800 tons. The new steamer, which has been built for Messrs. D. Burger & Sons, Rotterdam, is named the *Brinio*. Messrs. M. Paul & Co., Dumbarton, will supply the engines.

Pengwern.—On December 7, the *Pengwern*, an iron sailing ship, built to the order of Messrs. D. W. Davies & Co., ship-owners, Brunswick Street, was launched by Messrs. Russell & Co., of Greenock. Her dimensions are:—Length, 258·8 ft.; breadth, 38·2; depth, 22·9. Her registered tonnage is about 1,600 tons, and she has a cargo capacity of about 2,600 tons. The *Pengwern* is classed 100 A 1 at Lloyd's, but has been built under special survey with extra thickness of iron in excess of Lloyd's requirements. She is intended for the East Indian and North Pacific trades, but will take a first voyage to Buenos Ayres, and load on the Clyde with that object. The ceremony of christening the vessel (which has been named in compliment to Sir W. Grenville Williams, Bart., of Pengwern and Bodelwyddan Castle, who is pecuniarily interested in the ship) was performed by Mrs. Davies, wife of Captain Davies, formerly of the *Carnarvon Castle*, belonging to the same firm, and who has been appointed to the *Pengwern*.

Patricio.—On Dec. 7, the London and Glasgow Engineering and Iron Shipbuilding Company launched, for the Brasil Steamship Company, of Liverpool, this screw-steamer, to be engaged in the China trade. Her dimensions are 235 ft. by 31 ft. by 17 ft., gross tonnage about 1,200 tons. She will be fitted with compound surface-condensing engines of 130 nominal horse-power.

Lista.—On the 9th Dec. there was launched from the Caledon shipbuilding-yard (Mr. W. B. Thompson's), at Dundee, an iron screw steamer of 1,008 tons gross. She measures 205 ft. long, 29 ft. 6 in. broad, 21 ft. 9 in. depth in hold. She will be fitted with engines of 90-horse power. As she left the ways the vessel was named the *Lista* by Mrs. W. B. Thompson, wife of the builder. The *Lista* will be fitted with all the latest appliances for the rapid loading and discharge of cargo. She has been built to the order of Mr. Robert M'Andrew, of London, for Messrs. Miguel Saenz, of Seville, to the highest class at Lloyd's. She will be engaged trading between London and Spain, and will be commanded by Captain Asqueta.

Santa Maria.—On the 11th Dec. Messrs. John Elder & Co., Fairfield, Govan, launched from their yard a steel screw steam-yacht of the following dimensions:—Length between perpendiculars, 150 ft.; breadth, 22 ft.; depth moulded, 14 ft.; tonnage, according to yacht measurement, 330 tons. The engines, which are fitted on board by the builders, are on the compound principle, with 18-in. high pressure, and 36-in. low pressure cylinders, with 21-in. stroke, the steam being supplied by one cylindrical boiler with a pressure of 110 lbs. The yacht, which has been built to the order of Lieutenant-General Lord Alfred Paget, on leaving the ways, was named *Santa Maria* by Mrs. Potter.

Rosslyn.—On the 12th Dec. Messrs. Alex. Stephen & Sons launched from their shipbuilding yard at Linthouse a steel screw-steamer of about 1,750 tons, built to the order of Messrs. John Warrach & Co., Leith, and named the *Rosslyn* by Miss Agnes C. Kemp, of Ibrox. The *Rosslyn* has been built under special survey to class 100 A 1 in Lloyd's and is provided with water-ballast arrangements, steam-windlass, steam steering-gear, steam winches, and all the most improved appliances for the efficient working of the ship and cargo. The passenger accommodation is provided in a full poop aft, and is at once comfortable and elegant, while the officers and crew occupy respectively the houses amidships and the topgallant forecastle. The engines (also by Messrs. Stephen) are of the most improved type, have cylinders 33 in. and 62 in. diameter by 42 in. stroke, with ample boilers suitable for 80 lbs. pressure, and, as usual at Linthouse, were fitted complete on board before launching.

Embla.—On the 12th Dec., there was launched from the shipbuilding-yard of Messrs. S. and H. Morton & Co., Leith, an iron screw steamer of about 1,200 tons gross, named the *Embla*. She is built to the order of Messrs. J. T. Salvesen & Co., Grangemouth, for the Baltic and Mediterranean trade. Her dimensions are:—Length, 225 ft.; breadth, 33 ft.; depth, 16 ft.; and her engines of 120-h.p. will be supplied by Messrs. Blair & Co., Stockton. The vessel, which is a sister ship to the *Skulda*, launched by Messrs. Morton for the same owners in September last, was towed round to the Albert Dock to be fitted out.

Loch Tay.—On the 12th Dec. there was launched from the shipbuilding-yard of Messrs. Gourlay Brothers & Co., of Dundee, a steel screw steamer named the *Loch Tay*. Her dimensions are as follows:—Length, 256 ft.; breadth, 32 ft.; depth of hold, 18 ft. 11 in.; gross tonnage, 1,208; horse-power of engines 180. Windlass, Emerson & Walker's patent. The *Loch Tay* has been built to the order of the Loch Line Steamship Company, of Dundee, and is to be engaged in the Baltic, Mediterranean, and West India trades, and is to be commanded by Captain Rose, formerly of the *Loch Maree*.

Anaurus.—On the 13th of Dec. Messrs. Barclay, Curle & Co., launched from their shipbuilding-yard at Whiteinch, Glasgow, an iron sailing ship for Messrs. A. and J. H. Carmichael & Co., merchants, Greenock. The vessel's dismensions are 254 by 38·4 by 23, and her tonnage 1,650 gross. On leaving the ways she was named the *Anaurus* by Miss Gibson, of Hillhead. The vessel will be commanded by Captain Cook, late of the *Argus*, belonging to the same owners.

Elsa.—On December 13th, the Campbeltown Shipbuilding Company launched an iron screw steamer, of about 1,300 tons carrying capacity, dimensions being 215 ft. by 31 ft. by 15 ft., with raised quarter-deck, bridge house, and topgallant-forecastle, iron decks, water ballast, patent windlass, &c. She has been built to the order of Messrs. Robert Monteith & Co., for the Steamship Elsa Company (Limited), under the superintendence of Messrs. MacNicoll & Smith, Glasgow, and will be classed 100 A 1 at Lloyd's. She will be fitted with compound surface-condensing engines, of about 110-horse power nominal, by Messrs. Kincaid & Co., Greenock, and is intended to run in the fruit, ore, and coal trades, under the command of Captain William M'Kinlay, of Campbeltown. On leaving the ways she was named *Elsa* by Mrs. G. S. Dundas, wife of the Sheriff Substitute at Campbeltown.

Ashdale.—On December 13th, Messrs. Dobson & Charles, of Grangemouth, launched an iron screw steamer, of about 350 tons carrying capacity, which they have built to the order of Messrs. John Milligen & Co., of Glasgow, for the Clydesdale Steamship Company (Limited). She has raised quarter-deck, bridge-house, and topgallant forecastle, iron decks, water ballast, patent windlass, &c., and has been built to Lloyd's highest class, with excess strength, under the superintendence of Messrs. MacNicoll & Co., Glasgow, and to their designs. She will be fitted with compound surface-condensing engines of about 320 effective horse power, and is especially designed for the general coasting trade. On leaving the ways was named *Ashdale* by Mrs. John M. Slater, Glasgow, wife of the managing owner.

Port Gordon.—On the 16th Dec. Messrs. Russell & Co. launched from their yard in Port Glasgow an iron barque of the the following dimensions:—Length, 215 ft; breadth of beam, 36 ft.; depth of hold, 21 ft.; and about 1,100 tons burthen. The new vessel is named the *Port Gordon*, and is a sister ship to the *Port Glasgow*, the owners being Messrs. Crawford, Rowert & Co., Glasgow. The *Port Gordon* will load for Rangoon.

Mayrink.—On the 16th Dec. Messrs. D. J. Dunlop & Co. launched from Inch Works, Port Glasgow, a twin screw steamer which they have built to the order of Messrs. Joan Jose de Reis & Co., of Rio de Janeiro. The new steamer, which is entirely built of steel, is 180 ft. by 30 by 10 depth of hold, and has both main and awning decks laid of teak as well as all joiner and carpenter fittings exposed to the weather. She is intended to be a large carrier on light draft of water both in river and coasting services, and has accommodation for about 50 first-class passengers. The vessel is fitted throughout with the most modern appliances for working cargo, anchors, &c., and steering the ship. The engines, which are being fitted by the builders, are two complete pairs of compound surface-condensing engines of a collective power of about 100 horses, from which a high rate of speed is expected. The vessel has been designed from plans supplied by Guilherme Fox, Esq., of Rio de Janeiro, to whose orders the builders have previously built. The ceremony of naming the new ship *Mayrink* was performed by Mrs. Guilherme Fox, of Rio de Janeiro. When ready for sea the vessel will be under the command of Captain Joaquim Punta da Costa.

LAUNCHES.—SWEDISH.

Viking.—This steamer was launched recently from the yard of the Lindholmen Mekaniska Verstad, near Gothenburg. Her dimensions are:—Length between perpendiculars, 170 ft.: width, 23½ ft.; depth of hold, 16 ft. She is built of Bessemer steel made at Motala, and fitted with engines of 70-horse power, which, it is estimated, will give her a speed, when loaded, of 8½ knots per hour. The vessel is intended for the general carrying trade, and built to the order of Mr. J. C. Gjertsen, of Bergen, Norway.

Eada.—The latest addition to the Swedish navy was made on Dec. 1, by the launch of this gunboat from the royal wharf at Karlskrona. The vessel is a first-class war vessel, and the ninth of her type built during the last three years. Her dimensions are:—Length between perpendiculars, 186 ft.; length over all, 191.65 ft.; beam, 27.42 ft., and she draws, when fully equipped, 9.34 ft. of water. She will be armed with one 27-centimetre breech-loading gun, made by Sir W. Armstrong & Co., weighing 26½ tons, which will be mounted in the bow, and one 15-centimetre, also breech-loading, made at the royal gun-factory in Sweden, weighing 3¾ tons, which will be mounted in the stern. The projectiles for the larger gun will be shells of 508 lb. weight, while the charge used at the trial was 220 lb. of powder. This gun will be worked by hydraulic machinery, but the smaller by hand. Amidships she will carry two 25-centimetre Palmcrantz mitrailleuses, a gun similar to the Nordenfelt. Her machinery and boilers, which were fitted in her before the launch, were made at Borgsunds Makaniska Verkstad, Stockholm. The engines are of 975 indicated horse power, and the vessel is expected to make 13 knots.

LAUNCHES.—GERMAN.

Fero.—On the 13th December there was launched a new spar-decked steamer from the Flensburg Shipbuilding Yard, built to the order of Messrs. Schuldt & Co., in Flensburg. Her dimensions are:—Length, 219 ft.; breadth, 29 ft. 8 in.; depth, 22 ft., and she will be fitted with a pair of compound engines, 90-horse power, by the same company. This vessel is the tenth steamer launched this year by the Flensburg Shipbuilding Co. On leaving the ways she was named *Fero* by Miss Ella Constantine.

TRIAL TRIPS.

Lansdowne Tower.—This new steamer built by Messrs. Wigham Richardson & Co., for Messrs. Stumore, Weston & Co., of London, was tried over the measured mile on November 22nd, and the speed half loaded, was within a point of 13 knots, and everything worked to the satisfaction of all concerned.

Alesandro.—On November 25th, the *Alesandro* (s), built and engined by Messrs. Pearce Brothers, had a successful trial trip. The vessel left the Camperdown jetty at 11 o'clock, and, after having the compasses adjusted, ran the measured mile, on which she attained a speed of 11½ knots. The machinery worked with great satisfaction.

Coniston Fell.—On November 29th, the new steamer *Coniston Fell*, belonging to Messrs. Hume, Smith & Co., and built specially to carry dead weights, viz., pig iron, steel rails, blooms, &c., left the Sandon Dock, Liverpool, about noon, and proceeded down the river. The measured mile was run with and against the tide, the result being a mean speed of 10½ knots per hour, the engines running at 90 revolutions per minute. The engines, which combined all the latest improvements, were constructed by Messrs. D. Rollo & Sons, of Liverpool. The cylinders are 20 and 38 in. diameter respectively, with a stroke of 27 in., and receive steam from a large steel boiler with three furnaces, carrying a constant working pressure of 80 lbs. per square inch. The trip was in every way a success, and the vessel afterwards went direct to sea. Patent windlass by Emerson, Walker & Co., 11, Leadenhall Street, London.

Sir Garnet Wolseley (s).—On the 30th Nov. the new iron screw steamer *Sir Garnet Wolseley* had a successful trial trip off the Tyne. The vessel has been built and engined by the Palmer Iron and Shipbuilding Company, of Jarrow, for Messrs. Simpson & Page, of Newcastle, and she is the first vessel owned by that firm. Her dimensions are as follows:—Length over all, 303 ft.; between perpendiculars, 292 ft.; breadth, 37½ ft.; and depth, moulded, 26 ft. The dead-weight capacity is about 3,500 tons. The steamer is classed 100 A 1 at Lloyd's, and has been built under special survey. She has topgallant forecastle, long bridge, and full poop, main-deck iron, upper-deck iron, sheathed with yellow pine. The deck fittings include Emerson, Walker & Co.'s patent windlass, large steam winches, with Cochrane's patent multitubular donkey boiler, steam-steering gear, with patent screw hand-gear attached, by Messrs. Bow, M'Lachlan & Co., of Paisley. She has water-ballast tanks from stem to stern, forming a double bottom throughout on the cellular system. This arrangement renders it unnecessary to carry any ballast. The engines are compound surface-condensing, with cylinders of 36 and 68 in. diameter, and stroke 45 in.; steel boilers, to work up to 90 lbs. pressure, diameter 15 feet, length 10 ft. 6 in. Steam starting and reversing gear, Durham's patent governor, and M'Kenzie's patent vacuum regulator. The effective horse-power of the engines is about 1,250. The weather was fine, and a large number of ladies and gentlemen were present at the trial of the vessel, which was highly satisfactory to builders and owners alike. The ship was in ballast trim, and, although the sea was somewhat lumpy, she attained easily a speed of twelve knots per hour. The steamer is intended for the American and Australian trades, and her first voyage will be to New Orleans. She is specially adapted as a transport vessel. The *Sir Garnet Wolseley* will be commanded by Captain Morgan, of Newquay, Cardigan.

The Norseman (s.).—On December 7, the new screw steamship *Norseman*, just completed by Messrs. Laird Brothers, of Birkenhead, for the British and North Atlantic Steam Navigation Company (Limited), made her official trial trip, and, notwithstanding that there was a strong breeze from the N.E., and a considerable sea, the results were in every way satisfactory. She was under weigh from 8.45 a.m. till 9 p.m., and the machinery worked continuously without stoppage or the slightest hitch, being run for a time during the afternoon at full power, indicating 2 500 h.-p., and driving the vessel at a speed of upwards of thirteen knots. The *Norseman* is of iron, on the longitudinal bracket plan, and has three decks and awning deck, and a most complete water ballast arrangement for about 700 tons of ballast. The disposition of hatches, winches, &c., has had special attention, in view of affording ample means for the rapid loading and discharging of cargo, and the 'tween decks are specially ventilated on the most approved plan, and fitted for a large number of cattle. Her dimensions are:—Length, 390 ft.; beam, 43 ft. 6 in.; depth, 36 ft. 3 in.; with a gross tonnage of about 4,400 tons, and a deadweight capacity of 4,900 tons. She is fitted with inverted cylinder compound engines, which have been made by Messrs. Laird, and is rigged with four masts.

Sculptor.—On the 12th December a new steamer, named the *Sculptor*, which has been recently built by Messrs. Raylton, Dixon, & Co., Middlesborough, to the order of Messrs. F. J. Harrison, of Liverpool, proceeded to sea on her trial trip. The vessel is built to the highest class of Lloyd's, has passenger certificate, and is of the following dimensions:—Length, 260 ft.; breadth, 33 ft.; depth moulded, 21 ft. 7 in.; with a deadweight carrying capacity of over 1,900 tons; main deck laid with wood, and upper deck of iron, poop, forecastle, and long bridge with accommodation for officers and engineers underneath, cabins being fitted in poop. Her engines of 120 h.-p., are by Messrs. Blair & Co. (Limited), of Stockton, and in their usual good style and finish, but, owing to the prevalence of fog, she was unable to make the speed trial, and proceeds direct on her voyage from the Tees Bay. Ship and engines have been built under the inspection of Mr. R. D. Barrett and Mr. Cadman, for the owners, respectively.

Chirton.—On the 14th Dec. the new steamer *Chirton*, built by Messrs. T. & W. Smith, to the order of Messrs. Eskdale, Dodds & Co., North Shields, left the Tyne for Bilbao. After adjusting compasses, she was run over the measured mile, for the purpose of testing her engines, and the trial proved in every respect satisfactory, the speed attained being over nine knots. The engines were built by the Wallsend Slipway Co., and are a duplicate of those shown at the Tynemouth Exhibition by that firm.

TRIAL TRIPS.—GERMAN.

H. A. Hartman.—On Wednesday, the 22nd of November, the *H. A. Hartmann*, built and engined by the Flensburg Shipbuilding Company, run her trial trip in the Flensburg Bay. This vessel is built to the order of Messrs. H. N. Clausen, at Christianssund in Norway. Her dimensions are 174 ft. by 24 ft. by 14 ft. 8 in.; compound engines, 70-horse power. On the trial she realised a speed of fully 10 knots, this giving the utmost satisfaction to the owners. After the trial she proceeded on her first voyage to Pillau for a grain cargo to Newcastle, from where she will return to Christianssund and commence a regular run between Christianssund and Spain, with fish cargo.

Rugia.—Built for the Hamburg-American Company by the Vulcan Company, at Stettin, has lately made her trial trip. She is rigged as a three-masted schooner, and her principal dimensions are: Length, 350 ft.; beam, 42 ft. 6 in.; depth, 32 ft. 6 in. Her carrying capacity ie 3,800 tons of cargo, 100 cabin, an 1,200 'tween-deck passengers. She is fitted with a pair of two-cylinder compound engines, also by the Vulcan Company, indicated horse power 2,200. The trial trip was not altogether successful, as the condensers gave way, which are now, however, being replaced by new ones.

SHIP BUILDING.

THE docks at North and South Shields are, on the whole, pretty well employed. At Messrs. Smith's Dock, North Shields, the new steamer *Chirton* is now completed, and the new steamer *Dauntless* will be completed in a day or two. Two new steamers are framed, and one is being framed in the same dock.

At the Barrow Company's shipyard there is a considerable show of work in hand. There are six vessels on the stocks in various stages of construction, and besides these there are three large ships in dock fitting out, and a floating dock, which, though not yet completely finished, has already been several times used to advantage. The *City of Rome*, which, since her transfer to the Anchor Line Company, has required considerable alteration to meet the needs of her new service, lies at the quay next to the lately launched *Normandie*, which, while yielding to the English ship in point of size, is one of the largest vessels in the French Mercantile Marine.

Last year was one of unusual activity in the Clyde shipbuilding yards. Altogether 291 vessels, with an aggregate tonnage of 391,934 tons, were launched during the twelve months, as against 261 vessels representing a total of 341,022 tons, in 1881. The returns are thus 50,912 tons in excess of those of last year, which showed an increase of about 100,000 tons over the preceding year, and stood at the top of the list in comparison with any previous period. The wonderful progress of the great shipping industry on the river Clyde during the last quarter of a century will be seen from the following table showing the tonnage of the vessels launched annually since 1859:—

Year.	Tonnage.	Year.	Tonnage.
1882	391,934	1870	180,401
1881	341,022	1869	192,310
1880	241,114	1868	169,571
1879	174,750	1867	108,024
1878	222,353	1866	124,513
1877	169,710	1865	153,932
1876	174,824	1864	178,505
1875	211,824	1863	123,262
1874	262,430	1862	69 967
1873	232,926	1861	66,801
1872	230,347	1860	47,833
1871	196,229	1859	35,709

The use of steel in shipbuilding is steadily growing in favour alike with builders and owners. In 1879 the tonnage of steel-built vessels amounted to only 18,000, in 1880 it rose to 42,000 tons, and in 1881 to 66,609 tons. This year the steel vessels numbered 60, with an aggregate tonnage of 108,254 tons. The 291 vessels launched may be classified as follows:—War ships, 2; screw steamers, 172; paddle steamers, 14; sailing ships, 37; yachts, 8; barges, 21; barques, 5; hopper barges, 2; screw tugs, 5; steam launches, 10; lighters, 4; dredgers, 8; cargo flats, 3. The returns of the builders vary greatly, and range from 31,686, the total tonnage put into the water by Messrs. John Elder & Co., down to as low as 50 tons. All the great ocean lines received additions to their fleets from Clyde shipbuilding yards during the year. Messrs. J. & G. Thomson launched the Cunarders *Pavonia* and *Aurania*, the former 5,000, the latter 7,000; Messrs. Caird & Co. launched two Peninsular and Oriental liners, each 4,752 tons; Messrs. A. Stephen & Son four Clan liners, each over 2,500 tons; Messrs. D. & W. Henderson two Anchor liners, between 3,000 and 4,000 tons each; Messrs. William Denny Brothers a vessel of 4,000 tons for the British India Steam Navigation Company, and two vessels, each over 3,000 tons, for the Compagnie Nationale, Marseilles; Messrs. John Elder & Co. two vessels, each over 5,000 tons, for the Norddeutscher-Lloyd; while Messrs. Robert Napier & Sons launched two war vessels, each 3,773 tons. Notwithstanding the large amount of work done during the year builders are well employed, and the prospects are considered favourable. Many of the firms have orders for a larger amount of tonnage than they have put into the water during the year, and in most of the yards the stocks are well filled.

The returns of shipbuilding on the Wear during the year 1882, show an extent of tonnage unprecedented in the history of the shipbuilding industry on the river. Three new firms have commenced operations during the year, there now being 16, instead of 13, as in 1881. The number of vessels launched was 123, of 212,491 registered tons, and of 19,522 registered horse-power, as compared with 90 vessels of a tonnage of 154,932 and a horse power of 14,953 in 1881. Of the various firms, the greatest number of vessels has been launched by Messrs. Short Brothers, of Pallion—viz., 15, representing a gross tonnage of 26,685. Messrs. J. L. Thompson & Sons have launched 13 vessels, but these represent a tonnage of 27,891, being the highest on the river for the year. One of the finest vessels built by Messrs. J. L. Thompson was the spar-decked steamer *Toledo*, for the Indian and American trades. The steamships *Glenochil* and *Glengoil* were awning-decked steamers built for the Victoria line for Adelaide, Melbourne, and Sydney. The largest vessel ever built on the Wear was the *Mexican*, which was launched during the year, and was of 4,669 tons gross, and was built for the Union Mail Company, London. Messrs. Doxford & Sons have launched the *Kirkmichael*, which was the first steel vessel built on the Wear, and the firm have four more steel ships in hand. A few months ago the Sunderland Shipbuilding Company completed and launched the *Glenorchy*, which was the largest sailing vessel ever built in England. The marine engine building trade has been exceedingly active during the year. Eighty-five vessels have passed into the engineering works as compared with 72 in the preceding year. The following is a summary of the engines built by the principal firms:—

	No. of Engines.	Total h. p.	Average.
G. Clark, Southwick	23	4,436	193
North-Eastern Marine Engineering Works	22	4,150	189
J. Dickinson, Monkwearmouth	23	3,350	146
W. Doxford & Sons, Pallion	17	2,815	154
	85	14,751	682

LIST OF VESSELS LAUNCHED IN 1882

By Raylton Dixon & Co., Cleveland Dockyard, Middlesbro.

Name of Vessel.	Wood, Iron, or Steel.	Steam or Sail.	British or Foreign Owners.	Gross ton Register.	Horse power Nominal.
S. J. Oteri	Iron	Steam	Foreign	988	220
Joseph Arbib	,,	,,	British	1,900	170
Essex	,,	,,	,,	2,563	250
Middlesbro	,,	,,	,,	1,278	100
Hopper Barge	,,	—	,,	313	—
,, ,,	,,	—	,,	313	—
Scrivia	,,	Steam	Foreign	2,542	225
Admiral Rooke	,,	,,	British	1,369	130
General Eliott	,,	,,	,,	1,368	130
Sculptor	,,	,,	,,	1,336	120
Levenvale	,,	,,	,,	1,266	100
Louise	,,	,,	,,	1,584	150
Noord Brabaud	,,	,,	,,	2,493	250
Cousins Arbib	,,	,,	,,	1,900	170
S. Steamer. No. 210	,,	,,	,,	2,288	200
Henrietta	,,	,,	,,	118	40
Cairo, pro tem	,,	,,	,,	2,630	300
H.M.S. Dolphin	Composite	,,	,,	1,000	200
				27,249	2755

AVERAGE.—14 Screw Steamers, 1,822 tons gross, 180 H.P.
1 Gun Vessel, 1,000 tons displacement, 200 H.P.
2 Hopper Barges, 313 tons each.
1 Paddle steamer, 118 tons, 40 H.P.

IRON SCREW STEAMERS LAUNCHED IN 1882

By Messrs. E. Withy & Co., West Hartlepool.

Name.	Tons, G.N.M.	N.H.P.
City of Bristol	1292·91	135
Jeanie	1815·68	170
Ashton	1662·63	150
Roehampton	2143·47	180
Hypatia	2011·09	200
Burns	2192·95	180
Wellfield	1906·92	170
Silksworth	1347·11	130
Ingram	1748·31	150
Newcastle City	2129·11	200
Hartburn	1906·92	170
Allie	1748·00	140
	21,905·10	1,975

Reviews.

A Manual of Naval Architecture. By W. H. White, Chief Constructor Royal Navy, &c., London. John Murray, Albermarle Street.

TAKING up this subject from the point at which it was discontinued in our last issue, we might say that chapters 8, 9 and 10 may be well classed as another complete section of the work.

Chapter 8 deals with the strains experienced by ships. The longitudinal bending moments—hugging and sagging,—due to unequal distribution of weight and buoyancy, is well explained in the text, and illustrated in small diagrams, with methods of estimating bending moments, and the construction and uses of curves of weight, buoyancy, loads and bending moments, &c. In describing the influence of pitching and 'scending upon longitudinal strains, Mr. White says :—"Passing from the longitudinal bending strains experienced by ships in still water to those experienced when ships are at sea, it is evident that the latter strains must be far more severe and distressing to the structure. This arises principally from three causes. First, the existence of waves and the departures of the wave profiles from the level of still water will produce exaggerations in the inequality of distribution of the weight and buoyancy. Second, the rapid transit of waves past a ship will produce continual variations in the distribution of the buoyancy, these being necessarily accompanied by great and rapid changes in the character and intensity of the bending moments brought upon the structure. Third, the establishment of pitching and 'scending, movements in the ship, as well as of vertical heaving motions, will lead to the development of accelerating forces tending to increase the strain upon the structure."—This is followed by examples and formulæ for estimating local and distributed strains and forces brought to bear on a ship in every conceivable direction ; viz., the transverse strains experienced by ships when resting on the keel only, in dock or ashore ; when afloat in still water, or rolling among waves, the strains incidental to propulsion, by sails, screws, or paddles, and the local strains produced by grounding, loads on decks, collision, &c.

Chapter 9 is entitled The Structural Strength of Ships, and shows the gradual development of structural arrangements in all classes of vessels.

The construction of "equivalent girder" sections, the principles of the strength of beams and girders, and the application of each to the longitudinal strength of ships, is set forth in a highly instructive form, whilst the longitudinal and transverse strength contributed by different portions of the structure, and the laws which govern the scantlings for various requirements, cannot fail to strike the reader as being very complete and useful.

Chapter 10 deals with materials for shipbuilding, wood, iron, and steel. It opens with a description of the remarkable progress of iron ship building and the great increase in the sizes and speeds of ships of late years, and, the superiority of iron ships when compared with wood for strength, lightness, and durability. We then observe some useful remarks on the modes of scarpling timbers and shifts of butts in wood ships, and butts and lap joints in iron ships, as also on iron ships, being more easily built and repaired than wood ships, &c.

The final division or section of this work is embodied in four chapters, each of which deserve special attention. It commences in chapter 11, On the Resistance of Ships, and we can only add that it is refreshing to see in this chapter the results of the scientific investigations of native talent placed in a plain and readable form ; not only this, but it is also pleasant to record that English marine scientists and theorists no longer occupy a position in point of knowledge and investigation second to that held by European authorities as was the case up till within the last few years.

The descriptions of the theories, of Mr. Scott Russell, Professor Rankines, and Mr. Froude, are worthy of the greatest attention, as also is the culminating theory derived from such combined investigations.

Chapter 12, On Propulsion by Sails, contains the best data which can possibly be used in working out the various details of this method of propulsion.

Leaving this we come to a portion of the work which is specially adapted to the wants and requirements of the Marine Engineer, viz : Chapter 12, On Steam Propulsion. This chapter occupies 180 pages, and in this edition has been revised and augmented with the greatest care and attention. In opening this subject the author reviews the rapid development of steam navigation, in which he states that only forty-five years ago the employment of steamships in ocean navigation was a matter of warm debate, although steamers had previously been successfully employed on rivers, lakes, and for coasting purposes. These arguments were, however, soon practically destroyed, and since that time the onward developement of steam navigation has been continuous and rapid. The problem of steamship design as decided jointly by the marine engineer and naval architect, and the measures of horse power for marine engines are clearly explained. In considering the principal types of marine engines for different requirements, Mr. White gives some most useful information and examples of the greatest assistance to the engineer designer. This information includes examples of the weights and rates of coal consumption ; the advantages of economy in coal consumption ; the use of "forced draught ;" and the employment of locomotive types of boiler. The results of the experience obtained in the use of locomotive boilers are of the greatest value. The author, in continuance, notices the fundamental principle of the action of propellers ; the water-jet propellerand its applications ; and paddle-wheels. We then come to the important subject of screw-propellers, and the theoretical investigations of their action ; after referring to experiments carried out by Professor Rankine and Mr. Froude, Mr. White says. "It now remains to add a brief summary of the principal deductions made by Mr. Froude from his mathematical investigation ; they are as follow :—First, for maximum efficiency, the mean effective angle of the screw-blade measured from an athwart-ship plane, or "pitch angle," should be 45 degrees, which is obtained when the pitch is about twice the extreme diameter. Second, for maximum efficiency the slip-angle must vary directly as the square root of the co-efficient of friction, and inversely as the square root of the co-efficient of nominal pressure, which gives a slip of about 12½ per cent., with the values of the co-efficients adopted in the investigation. This is the *real slip* ; the *apparent slip* will usually be less, and will vary according to the amount and character of the disturbance of the water in which the screw works. Third, that for maximum efficiency, the area of the screw-blades may be expressed approximately by the formula :—

$$\text{Area in sq. ft.} = 8.9 \times \frac{R}{v^2};$$

where R = the resistance of the vessel (in pounds) at her maximum speed ; v = her maximum speed (in ft. per second). Fourth, that since, at moderate speeds, the resistance of a ship varies as the square of her speed, the same propeller should within those limits of speed drive a ship with the same per centage of slip ; but that outside those limits of speed the percentage for slip should increase. Sixth, that, if two ships have the same resistance at different speeds, the area of screw blades which will overcome the resistance while maintaining a given slip, will be less in the ratio of the squares of the speeds for the ship which has the higher speed. The last three deductions are obtained from the formula for blade area given above. Seventh, that the maximum efficiency which can be realised under the most favourable conditions is about 77 per cent. ; but that the per-centage of slip might be increased considerably (even as high as 30 per cent. with the screw working in undisturbed water) without any serious decrease of efficiency in screws of ordinary proportion."

These investigations are of the most approved nature, and, as Mr. White states, when supplemented with later mathematical analysis. approaches the nearest stage of accuracy yet attained in this direction. The results of trials by Dr. Lideman in Holland ; by Chief-Engineer Isherwood in America ; by our Admiralty ; Professor Reynolds, and others, are quoted to prove that they agree generally with Mr. Froude.

The author further deals with the comparative efficiency of single and twin-screws ; the necessity for experimental trials with each, and the novel description of some propellers, and compares the efficiency of screws with paddles and jets.

The author then enters into the estimates for the power and speed of steam-ships, in which the experiments of Mr. W. Denny and Mr. John Inglis, junr., are noticed. Summing up his statements as to "the ratio which the I. H. P. bears to the effective horse power" of a steamship, he says, this depends, (1) upon the efficiency of the mechanism of the engines ; (2) the efficiency of the propeller ; (3) the augment of the nett resistance of the hull produced by the action of the propeller ;" and shows the benefit of using these separately in the place of an approximation for the whole. We then read on to some co-efficients of performance, and to Mr. Rankine's "*augmented surface*" method, which closely resembles the present system used at the Admiralty ; next, the valuable assistance in speed-calculations derivable from *progressive steam-trials* occasionally made by vessels of the Royal Navy, by Mr. Thornycroft the torpedo boat builder, by Mr. Denny, of Dumbaston, and by Messrs. A. and J. Inglis, Glasgow, are shown to be most useful and reliable, and the application of estimates from experiments with models is also explained.

The last division of this chapter deals with steam-ship efficiency showing at the commencement that there is no universal standard possible, and giving the results derived from trans-Atlantic steamers, British iron-clads, Russian circular iron-clads, the *Livadia* and other types showing the influence of increase in size upon economical propulsion, the efficiency of torpedo boats and other swift launches, by Messrs, Thornycroft and Yarrow, and the expenditure of power in various classes.

The final chapter exhausts the subject of the steering of ships, and deals with the efficiency of every description of rudder, steering screws, water jets, mechanical steering paddles, steering by propellers, &c., &c., and brings to a close a most masterly and valuable work which, as we before stated, will be found to supply a want which has been felt for a long time by the naval architect and marine engineer throughout this country.

Coal : Spontaneous Combustion, and Explosions Occurring in Coal Cargoes, &c. Thomas Rowan.

THIS valuable work deals with a subject of the most vital importance to shipbuilders, shipowners and marine engineers. It also deserves the attention of Marine Insurance Companies. It is needless to detail the numbers of fine, well found, and well-built cargo vessels lost in mid-ocean without leaving any trace of the cause of such disaster. Some folks say the ship must have been badly constructed, others revert to different causes probably tending to such loss, but very little attention is paid to the numerous dangers arising from spontaneous combustion or explosion.

Mr. Rowan in his compact and highly practical work commences by describing the origin of coal, its geological position, varieties, the gases enclosed, the weathering of, the moisture contained in, and the absorbing power of coal. He then refers to the results of the Royal Commission of 1875 on the spontaneous combustion of coal in ships, and details the seven heads under which the report was summarized, and shows that although then the premiums on underwriting coal cargoes for long voyages were almost prohibitive up to this time, they have since increased. The commencement and indications of spontaneous combustion in coal, and the necessary treatment of coal cargoes under different circumstances of climate, weather, and length of voyage, together with the valuable tables carefully compiled on this head, are of the greatest use and importance.

The results of the inquiries of Royal Commissions, and the lists of questions and replies produced by the author in his appendix, should be studied by every one interested in this important subject ; as an illustration of the value of this appendix we would quote the contents of one chapter out of eight which it contains.

"APPENDIX D—*Tables relating to Combustion and Explosion.*—Table No. 1: Causes of explosion in British owned vessels.—Table No. 2: Explosions of gas in coal cargoes, in long and short voyages, in British owned vessels.—Table No. 3: Total numbers of known cases of spontaneous combustion, occurring in British owned vessels.—Table No. 4: Explosions in British owned vessels during ten years.—Table No. 5: Number of coal laden vessels reported missing during eleven years, ending December 31st, 1880,—Table No. 6: Number of coal laden vessels reported missing during ten years ending 31st December, 1880, distinguishing the vessels which sailed on short voyages from those which sailed on long voyages, and also distinguishing steam ships from sailing ships.

This useful treatise closes with a review of the particulars of the loss of H.M.S. *Doterel*, the explosion on board H.M.S. *Triumph*, and remarks on the conditions now existing on board ships of war and merchant vessels which by the nature of combustibles carried on board are liable to a repetition of similar disasters.

Mr. Rowan also furnishes us with a handy phamplet of "An Examination of the Origin of the loss of H.M.S. *Doterel* in which he shows that the very halting and conflicting opinions arrived at in the inquiries are very unsatisfactory, and concludes by saying, "It is not sufficient to know that coal gas or xerotine siccative and other gases 'may' be the source of producing such accidents. The great question now is, how best to prevent the recurrence of similar accidents? for it must not be loss sight of that these later accidents have not disclosed to us conditions that were before unknown, but are only *repetitions* of similar accidents, the conditions producing such having long before been unmistakably ascertained and pointed out—but *unheeded*. It is therefore, time that the possibility of such accidents continuing to occur should be dealt with by adequate legislation."

We fully endorse the opinions expressed by the author, and have no doubt that these would be shared by all readers of this pamphlet and the foregoing treatise on "Coal." Messrs. E. and F. N. Spon, Charing Cross, London, and 44, Murray Street, New York, are the publishers.

Correspondence.

[*It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.*—ED.]

DISASTERS AT SEA.

To the Editor of THE MARINE ENGINEER.

IN the August number you had occasion to notice the disaster to shipping, especially steamers with steam steering gear, owing to the faults of the same, and since then many more cases have been recorded; among the last that of the large passenger steamer, *City of Chester* of the Inman line to New York, which was spoken at sea in tow of the *City of Berlin*, another of the same fleet; both vessels no doubt will reach safely, but the money lost must be very heavy. A far more serious disaster is that of the S.S. *Regent*, of Liverpool, a vessel of some 1,500 tons, which, owing to loss of her steering gear, her stern and rudder post, was abandoned at sea by her crew, who were landed at Falmouth on the night of 20th instant; this was quite a new vessel with every modern appliance, but nothing new has been produced in the shape of the rudder since the days of Hiram and Solomon, and the Greek vessels which acted as transports for the warriors who sacked old Troy, and carried back the dark skinned and "ox-eyed" beauties as female slaves to improve the Grecian type. I have, however, had before me some plans which it seems may offer a mode of in future avoiding this terrible waste of life and property in our steam and sailing vessels, and I hope in next issue to say something on this subject, but, meanwhile shall be glad to have suggestions from all who are interested in the matter.

Yours truly,

December 18*th*, 1882. H. S. M.

SOME time ago the *Mercury*, at Portsmouth, was coated with two kinds of anti-fouling composition as a competitive trial, each inventor having a bow and a stern quarter allotted to him. The ship has just been docked, and on the plating being exposed the superiority of Colonel Crease's paint was made manifest. The *Mercury*, which will in all probability relieve the *Iris* in the Mediterranean is to be provided with a steel conning tower on the foremost bridge, and also with steam steering gear, as, in consequence of her extreme speed, it is difficult to turn her by hand. The existing after conning towers are to be retained as torpedo directors and for use should the forward tower be disabled. Engine-room telegraphs and voice-pipes from all parts of the ship will be led into the new tower, so that the officers fighting and navigating the ship may have complete control without exposing themselves.

THE STEAMSHIPS DIOGENES AND SOCRATES.—These two vessels, which at one time threatened to cause serious embarrassment between the German and United States Governments leading to a second Alabama case, arrived at Southampton on December 17th. It will be remembered that they were built at Kiel, and the German Government, having well-grounded suspicions that they were intended for belligerent purposes by a South American State, last year laid an embargo upon them. After considerable negotiations the question has ended by the purchase of the steamers by Messrs. Lambert & Co. of London, and the German Government raised the embargo on deposit of half a million of marks, or 25,000*l*. as a pledge that the steamers should sail directly for Southampton, and there be formally classified as British property.

SHIPBUILDING EXTRAORDINARY.—We learn from the *Morning Post* that an order has been received by a firm of shipbuilders on the Clyde for four new steamers, to be built of steel, capable of running 13 knots regularly, and powerful enough to face any gale on the Canadian lakes, for which they are intended. The order is given by the Canada Pacific Syndicate, and the vessels, after being built on the Clyde, are to be taken to pieces, transported in sections, and put together in Canada.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

November 25th, 1882.

Banks, Thos.	2 C	London.
Bell, Alex.	2 C	Glasgow.
Broughton, J. W.	2 C	Hull.
Buyers, James	2 C	Aberdn.
Cardigan, Alex.	2 C	Lvrpool.
Clucas, Wm. H.	2 C	do.
Constantine, R.	2 C	do.
Craig, William	2 C	Glasgow.
Craw, Donald	1 C	do.
Craw, John	2 C	do.
Gould, Chas. B.	2 C	Aberdn.
Gray, John	2 C	Glasgow.
Harris, Robert	2 C	N Shlds.
Hinckley, C. W.	2 C	Cardiff.
Horne, Adam	2 C	London.
Kerr, Robert	2 C	Glasgow.
Lovett, William	1 C	Livrpool.
Luckie, David	2 C	London.
McCaskill, Alex.	1 C	Glasgow.
McIntyre, John	1 C	do.
McKnight, Jsph.	1 C	Cardiff.
Murray, James	1 C	Livrpool.
Murray, Thomas	2 C	N Shlds.
Oliver, George	2 C	do.
Perivancich, John	2 C	Glasgow.
Pritchard, Ellis	2 C	Lvrpool.
Raeside, Thos.	2 C	Glasgow.
Rochester, T. N.	1 C	N Shlds.
Sharp, Wm. E.	2 C	do.
Smith, Alex.	2 C	Lvrpool.
Stephens, J. C.	2 C	London.
Thomas, John L.	2 C	Lvrpool.
Thomson, W. K.	2 C	Dundee.
Tyler, Harry T.	1 C	London.
Watson, William	2 C	Glasgow.
Watson, William	2 C	Lvrpool.
Watson, Alex.	2 C	London.
Walworth, T. B.	1 C	N Shlds.
Wilson, Geo. G.	2 C	Lvrpool.
Wildridge, Alex.	1 C	Glasgow.
White, Arch.	2 C	Glasgow.
Whittle, George	2 C	Hull.

December 2nd, 1882.

Angus, David	2 C	Glasgow.
Ballantine, James	2 C	do.
Bisset, John	2 C	London
Bowman, Hy.	2 C	Glasgow
Buck, Thos. R.	1 C	Sthmptn.
Campbell, P.	2 C	Glasgow.
Corner, Stephen	2 C	N Shlds
Dandie, John	1 C	London.
Darward, Edwd.	2 C	N Shlds.
Dewar, Alex.	1 C	Glasgow.
Elliott, Joseph	1 C	Sndrlnd.
Evans, John	2 C	Bristol.
Ewing, Andrew	2 C	London.
Fraser, Richard	2 C	Glasgow.
Gibson, John	1 C	do.
Gray, A.	2 C	do.
Harrold, John	1 C	Sndrlnd.
Heathcote, John J.	2 C	Sthmptn.
Henderson, Wm.	2 C	Glasgow.
Highet, William	2 C	do.
Ingls, George	1 C	London.
Kirby, Wm. E.	1 C	Sthmptn.
Lugg, Francis Hy.	1 C	N Shlds.
Marshall, James	1 C	London.
McFarlane A.	1 C	Sndrlnd.
McKinlay, Thos.	1 C	Glasgow.
McLintock, R.	2 C	do.
McNaughton, J.	1 C	Sndrlnd.
McRitchie, David	2 C	London.
Metzelaar, A. C.	2 C	Glasgow.
Munro, John	1 C	do.
Neilson, John	2 C	do.
Pinton, Alex.	2 C	do.
Rayner, Wm. J.	2 C	Bristol.
Scott, James	2 C	do.
Scott, John	1 C	N Shlds.
Shevill, John H.	2 C	Sndrlnd.
Sibbald, George	1 C	London
Smith, Duncan	2 C	Glasgow.
Smith, James	2 C	do.
Swift, John	2 C	Sthmptn.
Watson, William	1 C	Glasgow.
Wilson, Jas. R.	1 C	do.
Yarrow, William	2 C	N Shlds.

December 9th, 1882.

Addleshaw, G. F.	2 C	N Shlds.
Bertie, John B.	2 C	do.
Boxall, George	2 C	London.
Brew, Edward	2 C	Lvrpool.
Burnip, Geo. C.	2 C	N Shlds.
Cowell, Edwd. H.	2 C	do.
Derham, Joseph	2 C	Bristol.
Duggan, Robert	2 C	London.
Duncan, David	1 C	Lvrpool.
Elder, William	2 C	N Shlds.
Foreman, Thos.	1 C	do.
Fraser, Alex. G.	1 C	Lvrpool.
Hewson, Henry	2 C	N Shlds.
Higgins, John	2 C	Greenock
Jardine, James F.	2 C	Lvrpool.
Jones, Robert	1 C	do.
Major, George	1 C	N. Shlds.
Mitford, William	1 C	London.
Ritchie, Wm. D.	2 C	do.
Shute, Arthur E.	2 C	Lvrpool.
Sim, David A.	2 C	do.
Stevenson, M.	2 C	N Shlds.
Thomson, J. E.	2 C	do.
Walker, John	1 C	do.
Wright, Robt.	1 C	Lvrpool.

December 16th, 1882.

Anderson, James	2 C	Glasgow.
Bellew, Evelyn	1 C	do.
Bell, James A.	2 C	Plymth.
Bennett, J. G.	1 C	Lvrpool.
Carmichæl, R.	1 G	Glasgow.
Colquhoun, A.	2 C	do.
Crabb, Saml.	2 C	London.
Cranston, Andw.	1 C	Lvrpool.
Doyle, Aaron	2 C	do.
Flindt, E. J.	1 C	London
Fraser, John	2 C	Glasgow.
Halliwell, John	2 C	Lvrpool.
Hamilton, Robt.	2 C	Glasgow.
Hart, John	2 C	do.
Hendriksen, Vagn	2 C	London.
Hogg, James	1 C	Leith.
Johnson, Joseph	2 C.	Lvrpool.
Johnson, Thos.	2 C	London.
Jolly, James	1 C	do.
Kinniburgh, John	1 C	Lvrpool.
Kirkwood, Jas.	2 C	Leith.
Little, William	2 C	do.
Llewellyn, W. I.	2 C	Lvrpool.
Magee, James	1 C	London.
Major, James	2 C	Lvrpool.
Martin, Hugh	2 C	London
Marr, John	2 C	Leith.
McMillan, James	1 C	Lverpool.
Matthews, G. W.	2 C	N Shlds.
Muirhead, T. T.	2 C	Leith.
Pietsch, Alex.	2 C	London.
Ramsay, Michael	2 C	Leith.
Robinson, James	1 C	Lvrpool.
Simson, J. P.	1 C	N Shlds.
Smith, John	2 C	W.Hrtpl.
Sutherland, W.	1 C	Lvrpool.
Walker, John U.	2 C	London.
Watt, John	2 C	Glasgow
Wilson, Jas. N.	2 C	Leith.
Wilson, James	2 C	do.
Wilson, A.	1 C	do.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from November 21st to December 20th.

5476 R. T. Pawley. Ships' hatches.

5477 C. Cizzio. Motor engines.

5484 J. & Th. Kircaldy. Anti-fouling.

5511 S. A. L. Klixbüll (communicated to F. Wolf). Saving life.

5534 J. W. Jordan & J. Th. Brockliss. Distributing steam.

5541 G. W. Wade & J. M. Wardel (communicated to A. M. Clark). Rotary engines.

5544 G. & E. Ashworth. Furnace grates.

5553 W. M. Musgrave. Governors.

5555 G. W. Dyson. Boiler-flues, shells, joints.

5559 J. Varasseur. Ordnance.

5563 W. J. Sage. Propulsion of row-boats.

5570 W. R. Kinipple. Dredgers.

5621 A. J. Smith. Prevention of accidents to steam-boilers.

5622 L. C. Uhler (communicated to C. D. Abel). Tubular steam generators.

5628 W. Thornsby & R. Edwards. Steam-engines.

5656 H. Matheson. Steam-boiler with rapid circulation.

5672 C. F. Budenberg (communicated to A. Budenberg). Regulating apparatus for steam-engines.

5694 V. W. Blanchard. Combined furnace and steam-engine.

5725 D. J. Morgan. Tube stoppers.

5727 G. Taylor. Transferring, &c., waggons or trucks for loading and discharging vessels.

5732 P. Gibbons & A. S. Francis. Combined equilibrium and stop valve.

5750 L. Goodu. Regulating the cut-off in connection with steam-engine cylinders.

5763 F. von Stockhausen (communicated to P. Jensen). Protecting chimneys or funnels of ships of war against shot.

5768 C. Rideagh. Steam-engines.

5775 E. J. Harland, G. W. Wolf, W. H. Wilson, W. J. Pirrie. Raising, lowering, &c., ships' boats.

5816 F. J. Burrell. Governors for steam-engines.

5831 J. C. Stead. Steam generators.

5841 G. de Laval. Reducing friction between water and submerged bodies.

5843 John Burton. Fusible plugs.

5846 C. W. Morris. Rowlocks for boats.

5880 H. C. Patterson. Steam boilers.

5896 E. Martin. Ships' lamps.

5902 J. B. Hannay. Preventing corrosion on ships.

5909 F. Lebarq. Bedsteads.

5921 H. Dancey. Compound engines.

5923 D. Ammen. Sea-going vessels.

5969 W. Hargreaves. Valves.

5984 James Shepherd. Fire-grates.

5987 C. Scott. Hydraulic steering gear.

5994 J. L. F. Barbier. Steering ships, &c.

6007 John Williams. Furnaces.

6036 E. Wemshurst. Steering ships, &c.

NOTICE.—Owing to great pressure on our space, we are obliged to hold over the article on ' Electricity and its Modern Development, with special reference to Marine Engineering," until our next number.—ED. *Marine Engineer.*

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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

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The Marine Engineer.

LONDON, FEBRUARY 1, 1883.

EDITORIAL NOTES.

AFTER the many serious accidents that have occurred in the sinking of large liners, it is refreshing to hear that there is at least one Captain who is of opinion that in a few years all first-class passenger vessels will be practically unsinkable. His proposal, however, is to divide the vessel into at least ten compartments, exclusive of those occupied by machinery and fuel; but we have rather lost faith in water-tight compartments, as all vessels are supposed to be protected in that way at present. And further, the inconveniences to the area of the saloons and holds by many sub-divisions, are very serious. A further idea, which is perhaps more novel, is that the freight should be secured in water-tight packages, so that even if water-logged, the freight itself would serve to keep the vessel afloat. In such circumstances it is evident that heavy goods, such as rails, metals, &c., would have to be omitted in such first-class vessels. We shall be glad to see the production of first-class liners which should have a chance of floating, even after a serious collision. This is by no means a Utopian idea, and will, no doubt, be achieved in some way, when a number of sufficiently alarming accidents have occurred.

A GOOD deal of attention was attracted to the experimental launch, driven by an electric-motor, which was lately successfully tried on the Thames by the Electrical Power Storage Company. It may, however, be interesting to our readers to hear that such an experiment is as old as 1838. The invention of the electro-magnet before that date soon put it into the heads of mechanicians, that the attractive and repulsive force which could be so generated, might be developed into a simple and effective mechanical motor. Professor Jacobi, of St. Petersburg, constructed an electrically-driven boat in the year 1838, which had all the essential features of the modern electro-motors. Two series of electro-magnets of horse-shoe form were fixed upon suitable timber frames, and between them revolved a disc carrying a large number of straight electro-magnets. The shaft on which this disc was fixed was used to drive a pair of paddle-wheels, and thus the boat was successfully moved on the water. The attraction of the fixed magnets for those on the revolving disc whilst approaching, and their change to repulsion so soon as they were in juxta-position, was obtained by the use of notched copper commutators, almost exactly as at present, which changed the direction of the current at suitable intervals, to provide the alternate attraction and repulsion. This machine was first worked by a Daniell's battery of 320 couples, containing plates of zinc and copper 36 square inches each in area, and excited by a charge of sulphuric acid and sulphate of copper. The speed, however, attained by this arrangement was but poor, not exceeding 1¼ miles per hour. In 1839, however, an improvement was introduced by substituting Grove cells for motive power, in each of which the platinum plates were 36 inches in area. By this improvement the boat, which was 28 feet long, 7½ feet broad, and not quite 3 feet in depth, was propelled with a convoy of fourteen people, at a speed of 2¼ miles an hour. This was not a very grand result, from a modern point of view, but it is evident that there were in such an apparatus all the elements of success with a little modification. In the first place, as the motor drove the paddle-wheels direct, it had not a fair chance of developing the high speed which can now be given to a screw-motor; and, in the second place, it only required a sufficiency of battery power to develope any required speed. First inventions are always before their market.

THE two distressing and fatal collisions, ending sc lamentably for the splendid steamers the *City of Brussels* and the *Cimbria*, both during fogs, certainly emphasise this danger as the gravest to all first-class steamers that now exists. To steamers that can weather a hurricane at sea, and to which a lee shore in a storm is no danger, there seems to be much less danger from wind and weather than was ever the case in former days. This is certainly true, but the rapid and increasing crowding of the most frequented channels and ports, brings the danger of collision into prominent and startling notice. There is not always a fog to excuse the blundering of big steamers into one another in the most unaccountable manner, and it certainly behoves our engineers and naval architects to exercise their ingenuity in dealing with this new and appalling danger. What is to be done? First, let us analyse the causes and chances of such dangerous proximity. There is obvious and continuous crowding of the most frequented waterways, which surely now demands regulation of the traffic as much as crowded City thoroughfares do. Why not have a "rule" of all channels, or even of the Atlantic, as well as a "rule" of the road? Is it not possible that the danger of collision may be a great deal more inevitable than is generally supposed? Matter attracts matter, and by a force which increases as the square of the mass or weight. May not, then, the enormously increased mass or weight of two first-class liners, or of two ironclads, attract each other to their mutual destruction, as much as, and to an infinitely greater extent than, two chips attract each other when floaing on the water? In a fog, then, where the first divergence of course towards one another is not seen, are not the chances of collision much greater than that the vessels will pass without touching? We think that at any rate the murderous upright cut-waters, which so effectually sink a vessel into which they run, should be at once abandoned. Why should not "buffer" cut-waters be applied to the mercantile marine, to prevent danger from accidental ramming, with as good sense as the development of "rams" in ironclads for destructive effect?

NAVAL architects have just received a handsome testimonial as to their ingenuity and skill on behalf of their employers, from Mr. Dobree, of the East and West India Dock Company, who states that "registered tonnage," as measured by present Act of Parliament, is no test of the real capacity of many of the modern steamers. Although the company find that their apparent "tonnage" is falling off, they find that the tons of cargo delivered over their wharves is greater than ever. Many vessels now carry, as a usual cargo, much more than their registered tonnage, and it is said that in the case of the *Colomba*, working on the Clyde, her registered tonnage is less than "nil." These anomalies result from a skilful treatment, in the design of the "allowances," in respect of space for engines, coal bunkers, and other purposes, which are permitted by the Act. This is not a new complaint. The report of the Royal Commission upon the subject draws attention to the same matter. As the dock, port, canal, and other dues are much reduced for actual freight carried by this ingenuity of design, we must look upon it as a premium on ingenuity until the Act rights itself, as it will, no doubt, in course of time. As ship-owners have had rather a hard time of it for some years back, one cannot but smile at such neat dodging to help to make both ends meet somehow. If it has helped to keep freights low, the public at least has benefited, and the natural increase of the shipping ought to keep vested interests in dues, &c., from feeling it.

WE see that the first batch of Engineer students, educated under the new arrangements on board the *Marlborough*, at Portsmouth, will pass out of the ship into the Navy this year to the number of forty. We hope they will do their training credit. Their Lordships are now introducing an innovation, in reserving a right to nominate one-fifth of the whole number of entries as students. These nominations will be made by the Board from the sons of officers of the Navy, Army, or Royal Marines, who have been killed in action, or have been lost at sea, or have died of wounds or injuries; or sons of officers who have performed long and meritorious services. We think this a very proper regulation, and one likely to afford great encouragement and aid to the officers of the Navy, so long as the Engineers are fairly well remembered for their share of such nominations.

MARINE AND MECHANICAL ENGINEERING AND METAL TRADES' EXHIBITION.

AN Exhibition of this class, representing industries in which is invested such a large amount of national wealth, and which involves the employment of millions of our population, cannot but be of the greatest interest and importance.

These are the words used by Mr. Samson Barnett, Jun., who it will be remembered so successfully conducted the Naval and Submarine Exhibition of 1882, and who is again coming forward this year with the above-named scheme. In stating his reasons for again collecting under one roof, for a space of time, samples of the inventions and manufacture of several hundred firms, he says:—"The recurrence of these Exhibitions obviates the necessity for firms having a depôt in the heart of the City to show samples of their principal manufactures, as buyers look forward to the Exhibition as representing the latest improvements in the articles they are interested in. New inventions at once reap the prize of commercial success, as they are immediately brought under the notice of those most interested in their adoption, and the great advantage of its being held in the commercial capital of the business world, enables this Exhibition to be visited by the principals of the various foreign importing firms, who, being advised in their own language many months in advance, can arrange to be present. In order to be brought into direct personal communication with the heads of firms exhibiting, buyers must of necessity visit an Exhibition, as they could not give the time necessary to visit the various establishments represented individually. The comparatively short time during which the Exhibition will be open enables principals to be present, instead of being merely represented by attendants. The advantage of this fact was manifest at the late Naval and Submarine Exhibition, where a very large amount of direct business was transacted." He then proceeds to show that publicity, the "life of business," is best secured by having an abridged price list printed in the Official Catalogue, which represents to buyers the latest Directory of existing firms. It is well known that loose sheets and lists are seldom kept, or, if kept, are not to be found when required; but the combination in a single handy volume, exhaustively indexed, is simply invaluable for reference.

These remarks are not in any way overdrawn when applied to an Exhibition which is carefully and faithfully worked in the interests of the exhibitors and the visitors. That this may be expected has been well established by precedent, and is further assured by the complete arrangement even now made, although the date of opening is fixed for July 5th, to remain open to July 21st inclusive, the Agricultural Hall, Islington, being the spot again fixed upon for this purpose.

Notwithstanding the fact that three Exhibitions were held last year in London, and one in Tynemouth, in all of which marine specialities were embodied, the firms who obtain publicity and advance business in this manner are so satisfied with the results of former experience, that over one-fourth of the available space has been already secured for the forthcoming Marine and Engineering Exhibition. Another fact, which speaks volumes in favour of the popularity of Mr. Barnett's endeavours, is that nearly the whole of the present spaces now engaged have been taken by firms who exhibited under his successful management in April last, and in most instances these firms eagerly take double and more than double the amount of space they formerly occupied. At the same time it should be stated that the models, or actual appliances in full size, now being prepared at many factories and workshops, are to be got up in the most perfect and highly-finished style possible. This is on account of the experience gained in former similar competitions, having given a great impetus to inventive and mechanical excellence in manufacture. Owing to this prominent spirit of rivalry in the perfection of all classes of machinery and appliances, the professional visitor will reap the benefit of judging and selecting from the very best of each class that can possibly be obtained.

The forthcoming Exhibition is divided into seven sections of Engineering.

First.—*Marine Engineering*, which comprises Dock, Harbour and Lighthouse Work, Pile Driving, Dredging, Excavators and Contractors Plant, Marine Engines, Shafts, Propellers, Governors, Condensers, Steering Gears, Winches, Cables, Anchors, Artillery, Small Arms, Diving and Wreck Raising, Life Rafts, Flexible Steel Wire Rope, Iron Wire Rope, Hemp Ropes, &c., &c.

Second.—*Casting, Forging, and Rolling*. This section applies as much to Marine work as to general engineering.

Third.—*Gas, Water, Sanitary, Electrical, and Telegraph Engineering*. To the Marine world the three last named are of the utmost interest and importance.

Fourth.—*Hydraulic and Pneumatic Engineering*. This section again applies in many particulars to Marine requirements, as well as to general engineering.

Fifth.—*Workshop Tools and Appliances*. Under this head will be exhibited various machines and tools of universal use and importance to every branch of the engineering profession.

Sixth.—*Mining*. This section does not affect Marine matters generally, unless some information may be gained as to the explosive and combustive nature of coal, and the best preventives in existence for counteracting disastrous effects of the same.

Seventh.—*Treatment of Raw Produce*. From this section the mariner may gather some good information as to the nature of raw goods, and the special precautions which should be observed in many instances in the stowage and ventilation of same on board ship.

This brief outline of the general characteristics of the forthcoming Marine and Mechanical Exhibition will satisfy any merchant, manufacturer, professional authority, or mechanical engineer, that Mr. Barnett has, in a most business-like and masterly manner, grasped a combination of engineering research and skill which embodies subjects of great international importance, and will call forth the attention and, in many instances, the presence of interested authorities from all parts of the world.

Amongst the number of Exhibitors we might mention some of the most prominent, as the entries stand at present:—The Leeds Forge Co., Iron and Steel Manufacturers, New Wortley, Leeds; Messrs. Hopkinson, Boiler Makers; The Kirkstall Forge Co.; and Messrs. Cochran & Co., Birkenhead, Patent Vertical Multitubular Boilers, take the lead with large and heavy exhibits respectively occupying spaces of 800, 600, 300, and about 250 square feet in area; Clarke's Crank Co. (Limited), Lincoln; The Anchor Tube Co., Birmingham, also exhibit heavy material. Messrs. Burrell & Sons, of Thetford, Norfolk, will show a full-sized Marine Engine of their special and improved manufacture, and Messrs. Davis, of Abingdon, their Yacht Engines; M. Gandy & Co., of London, Gandy's Patent Cotton Belting; Tweddell's Hydraulic Rivetting Machines; C. D. Davis & Co., and Amos Smith & Co., Steam Steering Gear; Messrs. Durham, Churchill & Co., Marine Engine Governors; Messrs. Pearn & Co. Pumps in Motion; Messrs. Chadburn & Co., Engine-room and Steering Telegraphs; Messrs. Normandy's Co. (Limited), Distilling Machinery and Condensing Apparatus; Messrs. Loudon Brothers, Glasgow; Messrs. Archdale, Birmingham; Messrs. J. Churchill & Co., American Manufacturers; and Selig Sonnenthall, Machine and Engineers' Tools; Messrs. Gardner & Battely, Maidstone, and J. Durant, Brass Work and Fittings; G. H. F. Beamish, Ireland, Model Breakwaters; Messrs. Utley & Co., Liverpool, Ship's Ventilators; The Phospor Bronze Co., and E. S. Copeman, with his celebrated life raft. The display of Flexible Steel Wire Ropes, Iron Wire Ropes and Hempen Ropes, at present rests with two firms—viz., the Hartlepool Rope Co. (Limited), and Messrs. Felten & Guilleaume, Cologne.

We are aware that very shortly most important additions will be made to the collection already booked, and in putting them together under their different sections we shall be able to show how the deserving energy and enterprise of Mr. Samson Barnett has been rewarded by the responses of prominent British and foreign manufacturers.

STEAMSHIP PERFORMANCE.*

By John W. Nystrom.

(*Continued from page* 265.)

CHIEF ENGINEER ISHERWOOD says in the September number of the JOURNAL, page 144, that "the entire resistance of the vessel was sensibly that of the water to its immersed external surface; and, consequently, no engine power was expended in overcoming the resistance of the water to displacement by the progress of the vessel. That is to say, the difference between the power exerted by the fore body of the vessel in raising the displaced water from the centre of gravity of the greatest immersed transverse section of the vessel to the general water level, and the power exerted upon the after body of the vessel in the direction of its motion by the ascending column of water caused by the forward movement of the vessel, were sensibly equal," etc.

These ideas conflict with the science of hydraulics.

The horse power required for friction in the moving of a surface in water is found in the following way:

S = speed or velocity, in feet per second, and of a surface through water.
M = nautical miles per hour of the same surface.
k = coefficient of friction, or the force, in pounds, required to move one square foot friction surface with a velocity of one foot per second.
A = friction surface, in square feet.
L = length of the friction surface in the direction of motion.
F = force, in pounds, required to move that surface.

$$F = \frac{AS^2k}{\sqrt[4]{L}}, \text{ of which the horse-power is H.P.} = \frac{A\ S^3\ k}{550\sqrt[4]{L}}$$

When the velocity is expressed in nautical miles, of 6,086 feet each, the force and horse-power will be

$$F = \frac{6086^2\ A\ M^2\ k}{(60\times60)^2\sqrt[4]{L}} = \frac{10288{\cdot}7\ A\ M^2\ k}{\sqrt[4]{L}}$$

$$\text{H.P.} = \left(\frac{6086}{60\times60}\right)^3\frac{A\ M^3 k}{550\sqrt[4]{L}} = \frac{A\ M^3\ k}{113{\cdot}935\sqrt[4]{L}}$$

Example.—Required the horse-power of a smooth copper surface, $A = 5698$ square feet, for which $k = 0{\cdot}0045$, moving with a speed of $M = 10{\cdot}75$ nautical miles per hour, when the length $L = 174$ feet.

$$\text{H.P.} = \frac{5600\times10{\cdot}75^3\times0{\cdot}0045}{113{\cdot}935\times\sqrt[4]{174}} = 75{\cdot}653 \text{ horse-power.}$$

Chief Engineer Isherwood says 266 horse-power.

The horse-power required for propelling the steamer *Dispatch* at a speed of $M = 10{\cdot}75$ nautical miles per hour, with the resistance given by the formula 16, should be

$$\text{H.P.} = \frac{6086\ M\ R}{60\times33000} = \frac{10{\cdot}75\times8117{\cdot}1}{325{\cdot}337} = 268{\cdot}21 \text{ horse power.}$$

Chief Engineer Isherwood says 269·17 horse-power.

The horse-power consumed by friction of the water against the propeller blades is found by the following formula:

$$\text{H.P.} = \frac{k\ \mathbf{R}\ L\ N\ n^3}{59400000\ P}(311{\cdot}71\ \mathbf{R}^4 + 26{\cdot}319\ \mathbf{R}^2\ P^2 + P^4)$$

See Nystrom's "Elements of Mechanics," pages 178 to 181 inclusive, for explanation how this formula is obtained.

For the propeller of the steamer *Dispatch* we have given $\mathbf{R}$ = 5·55 feet radius; $L = 1{\cdot}4583$, the length in the direction of its axis; $P = 19{\cdot}9$ feet pitch; $N = 4$ blades; $n = 64{\cdot}533$ revolutions per minute; k = friction coefficient, which for smooth finished brass is 0·0045. The friction horse-power will then be

$$\text{H.P.} = \frac{0{\cdot}0045\times5{\cdot}55\times1{\cdot}4583\times4\times64{\cdot}5333^3}{59{,}400{,}000\times19.9}(311{\cdot}71\times5{\cdot}55^4 +$$
$$26{\cdot}319\times5{\cdot}55^2\times19{\cdot}9^2 + 19{\cdot}9^4) = 20{\cdot}73 \text{ horse-power.}$$

Chief Engineer Isherwood gives the friction horse-power to be 25·62, with the friction $k = 0{\cdot}0045$, for which the same formula has probably been used. This savant, I believe, was the first one to appreciate the value of and to determine the friction horse-power of screw propellers, and his first process was very laborious.

To find the horse-power required for driving a vessel a given speed.

For this purpose, like for the resistance, it is necessary to know the shape of the vessel, that is, its exponents, angles of resistance, greatest immersed section, wet area of the hull, etc.

$$\text{Call } [X] = \left[x\left(0{\cdot}9\sqrt{\sin.^3 v} + 0{\cdot}1\sqrt{\sin.^3 V}\right) + \frac{A\ k}{\sqrt[4]{L}}\right]$$

This is the factor of resistance, which in the case of the *Dispatch* is $[X] = 24{\cdot}577$.

The horse-power required for driving a vessel of any form and size will be as follows:

$$\text{H.P.} = \frac{M\ R}{325{\cdot}337} = \frac{2{\cdot}858\ M^3}{325{\cdot}337}[X]$$

By eliminating the coefficient 2·858, the formula for horse-power becomes

$$\text{H.P.} = \frac{M^3}{113{\cdot}82}[X]$$

The indicating horse-power of the engine should be about 50 per cent. more for working the pumps and frictions of the engine and propeller.

The speed with which a steamer will run with a given horse-power will be

$$M = \sqrt[3]{\frac{113{\cdot}82\ \text{H.P.}}{[X]}}$$

The steamer *Dispatch* is constructed very near like the steam propeller represented on Plate X, N. P. B., of which the general formula appears on page 446. A general formula for the *Dispatch* may be set up as follows:

$$\left\{\frac{W\ 2{\cdot}5\times1}{D\ \ 2{\cdot}5\times2}\right\}\ 65\ \left(\frac{174\times25\times12}{x\ 2{\cdot}5\times1}\right)\ 109\ \left\{\frac{W\ 2\times1{\cdot}5}{D\ \ 2{\cdot}5\times2}\right\}$$

Any one who understands the parabolic method can construct a vessel like the *Dispatch* from the above formula, and he can know all the properties of the vessel before a single line of it is laid down for the drawing. The parabolic method enables the shipbuilder to reason with certainty and clearness about forms of ships.

The order of proceedings in the ordinary or old method of constructing ships is as follows:

Some boards are planed up, and put together with wooden pins, from which a model of the intended shape of the vessel is carved out according to the rule of thumb judgment, and several models are often made before a desired shape is obtained. When the model is finished it is taken apart, and each board is laid on the drawing paper for drawing the corresponding water lines therefrom. After all the water lines are so drawn, the body plan is made therefrom.

From this drawing the lines were laid down on the ship's floor by the aid of scale of measurements. If it is desired to know correctly the properties of the vessel, such as areas of water lines and cross-sections, displacement, centres of gravity, metacentre, etc., calculations are made by the rules of Chapman or Simpson, which is a very laborious process, very seldom carried out, but the shipbuilders rely upon their experience in approximating these data sufficiently near for practical purposes.

With the parabolic method of constructing ships the order of proceedings is the reverse of that of the old method, namely, as follows:

First, set up a formula for the desired shape of the vessel, from which calculate the ordinates, areas of water lines and cross-sections, displacement, centres of gravity metacentre, etc. From the so obtained data lay down the lines on the drawing for the complete vessel. If a model is required make it from the drawing. Then lay down the lines on the ship's floor, not altogether by scale measurements, but from the original calculation, because the scale measurements are not reliable when enlarged from the drawing to the full size of the ship.

The calculations required by the parbolic method is about one-tenth of that by the Chapman's or Simpson's rules.

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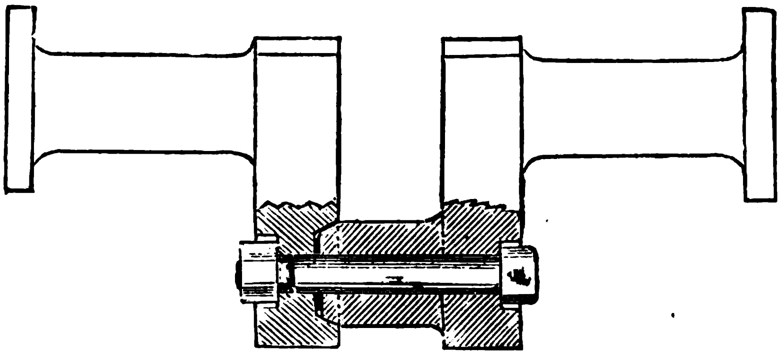
*From the Journal of the Franklin Institute

CRANK SHAFTS FOR SCREW STEAMERS.

We wish to draw attention to the crank shaft system being introduced by Mr. Purves, as shown in the engraving on this page. The ground work of reasoning on which this construction has been arrived at is, that as shafts have been made larger, they have been found to fail more and more in coming up to their calculated strength, and that defect is due to the increase of rigidity, and that the solid shaft breaks not from want of strength, but at first merely to allow one part of itself to work independently of another part. When the surface of this selfbreaking is cupped, and in the crank pin, a through bolt to keep the two parts together repairs the shaft effectively, and such shafts run on for years really the better for being in two, and without any tendency to break at another section. Mr. Purves forms the shaft at first with such a cup connection at the best place, so as not to have the selection of a place of fracture to the chance result of the complex training of a solid crank. The long bolt holds all together, it is reduced in the body to be a little less than the section of the bottom of the thread, so that the little accommodation shift required in the working of the shaft, owing to unavoidable unfairness of bearing or overheating of crank pin, may be permitted by the safe elasticity of the long steel bolt. While an engine is working under normal conditions of tear and wear, there is every revolution a relative yawning to some extent of the planes of the two crank webs. This has been measured in some instance to amount to an opening and closing of the jaws of a shaft from ·012 to ·022 of an inch. The cup connection in Purves's will allow for this by an almost insensible shifting of the cup surfaces upon each other. This movement, which is provided for as shift in this instance, would be in a solid shaft *strain*, located in the action of the neck of the pin, or in that at the neck of the main bearing, and it is that localized straining which is supposed to break large shafts. The weak point in marine engines at present is the crank shaft, and this is how broken shafts seem to indicate that they should like to have been made. The working of the webs is as likely to result in fracture at the neck of a main bearing as at the neck of the crank pin, and then the through bolt repair cannot be applied. When made originally with the cup connection, as according to Mr. Purves's plan, the surface shift at the cup does away with both sets of localized strains, those at the pin as well as those at the main bearing.



THE VENTILATION OF SHIPS.—No. 5.

Very careful precautions should be adopted for the carriage in ships of benzoline, naphtha, turpentine, petroleum, or of mixtures containing them, as xerotine siccative, or "patent dryers," &c., as the vapours from these volatile and inflammable substances are very dangerous. One volume of benzoline will cause sixty volumes of air to be highly inflammable, and when mixed with thirty volumes of air it is explosive. Some important chemical testimony concerning the injurious results likely to occur from these dangerous stores is given in the report of the explosion of gunpowder on board the canal boat, *Tilbury*, in Regent's Park in 1874. This information was communicated to Colonel Majendie, the Government Inspector of Explosives, by Mr. T. W. Keates, Consulting Chemist to the Metropolitan Board of Works, who has specially studied these substances. According to his statement, one cubic inch of liquid benzoline when volatilized will render inflammable no less than five cubic feet of air, and Dr. Taylor, the eminent toxicologist, says in reference to such explosives, that the weight of this small quantity of benzoline would be equivalent to one tablespoonful, and "is convertible into 116 inches of vapour having a specific gravity of nearly 4, as compared with air when thoroughly mixed as vapour with 60 times its volume of air (116+6,960=7,076 cubic inches) and a lighted taper is applied; the mixture burns with a beautiful pale blue flame, and if the glass vessel containing the mixture is long and narrow, there is rather a smart explosion at the end."

After having referred to the memorandum of experiments made with petroleum in connection with the Regent's Park explosion, at the Royal Laboratory at Woolwich, by Colonel Majendie and Professor Abel, we agree with the assertion of Mr. Rowan, that if there is a leakage of the receptacle containing volatile and inflammable substances, or through badly fitting corks or coverings, small quantities of vapour may escape and render a large volume of air inflammable, which on contact with a naked light may convey a flame long distances from its source, and which may end in a gunpowder magazine. Thus there were on board the boat *Tilbury* just before the explosion, 5 tons of gunpowder and 4 barrels of benzoline in the hold, and the cabin communicated with this portion of the boat by a small ventilating hole. As some of the benzoline escaped by leakage, and being mixed with the air formed an explosive and inflammable gas, and thus having made its way through the hole in the cabin, caught fire by the open light therein, and the flame being taken back to its source caused the terrible gunpowder explosion referred to.

A disastrous explosion also took place on board H.M.'s flagship *Triumph*, when off Coquimbo, on the coast of Chili, on Nov. 22nd, 1881, from the accidental ignition of xerotine siccative, which was stowed under the paint room, contrary to the instructions of the Admiralty. It appears that an unprotected light was taken into the compartment containing this inflammable substance by a marine who was immediately blown to pieces. Two other men on board were also killed by the explosion. The beds in the "sick bay," outside the paint room were also wrenched out of the deck, and the inmates were thrown all over it.

After this accident special attention was given to the dangerous properties of xerotine siccative, which is used to prevent corrosion between the double bottoms of ironclads, and a committee was appointed by the Admiralty to make close enquiries concerning such, and in its relation to the loss of H.M.S. *Doterel*, which was destroyed by explosion in the Straits of Magellan, on the 26th of April, 1881, as xerotine siccative was known to be on board this ship. In consequence of this committee not being able to come to any definite conclusion concerning this accident, their report has been referred to Admiral Luards' Committee on Gas Explosions, and we have received information from the Admiralty Office that the report of this second committee will be issued in a few days hence.

Now before offering any remarks upon the means of ventilation which may be adopted to prevent spontaneous combustion of coals in ships, it is advisable to notify a few extracts from the report of Dr. Percy and Professor Abel, published in the Report of the Royal Commissioners on this subject, in 1876. They state, "As regards the application of ventilation with a view to reduce the liability to spontaneous ignition of a cargo of coal, the only useful object which could possibly be arrived at by ventilation would be the rapid abstraction of heat developed in the coal (by chemical changes set up as described) by causing cool air to circulate freely and rapidly throughout the body of a mass of coal. The attainment of such a result, even by powerful means, of artificial ventilation elaborately applied, and with the coal in the mechanical condition most favourable to its free permeation by air, appears, to say the least, very doubtful, and there can be no question that any system of ventilation practically applicable on board ship would fail to attain such a result, even disregarding the fact that the mechanical (finely divided) condition of much of the coal constituting a cargo is quite antagonistic to the free passage of air through its mass. It does not appear practicable, therefore, to apply ventilation with any prospect of guarding against the accumulation of heat in some portion of a coal cargo. Such circulation of air as may be established even in the less compact portion of the cargo is not likely to have any valuable cooling affect, and the circulation, if there be any, must be very feeble among the more closely lying masses of small coal, so that heat if developed in these will accumulate undisturbed; indeed, its development would possibly be favoured by the fresh supply of oxygen which a gradual replacement of the air surrounding those parts would convey, so that a period would be reached, sooner or later, when the development of heat would be most seriously promoted by ventilation, sometime before actual ignition demanded the total exclusion of fresh air. The evidence which has been submitted to the Royal Commission on the subject of the ignition of coal cargoes, bears out generally the conclusion to which the above considerations lead, namely, that it is unavoidable to attempt through ventilation of cargoes in coal laden ships. Mr. Rowan, who entirely agrees with these conclusions, in notifying the means he would adopt to prevent spontaneous combustion of coal cargoes by ventilation, states that he should have a method of abstractors placed throughout the coal holds, at various levels, among the fuel, when the abstractors could be brought into action as occasion required, and which could be determined "by thermometric indications from thermometers placed in the abstractors themselves." If any chemical action was going on, the gases evolved by such process could be drawn off by the abstractors, and the danger "from contact of the heated products of incipient combustion lodging amongst the body of the coal, and thus inducing or exciting action of a similar nature in other parts of the cargo, be avoided." To prevent atmospheric air penetrating the coal in holds "the surface abstractors could always be brought into operation when abstracting from below, and might also be worked at greater pressure." He also recommends that when coal is to be shipped on long voyages, or when it is known to be intrinsically dangerous, that it "should be taken from the pits in shallow iron waggons, with perforated or open bottoms or sides—say lattice work, or similar construction, prior to shipment, these waggons (with their contents) should be run into properly constructed stove-houses, and there subjected to the action of heated air, say from 150 deg. Fahr. and upwards, and varying from 24 hours to 7 or 8 days—the time and temperature being of course dependent on the motion of the coal under treatment. It should then be allowed to cool, protected from the influences of the weather. By these means the carbonaceous oxidation of the coal would be artificially excited and promoted up to a point when any further action on board ship from this source would never be energetic enough to cause much appreciable heat, if any. This treatment would also ensure damp or moisture being driven off, and thus the possibility of pyritic oxidation taking place would be reduced to a minimum. At the same time a very considerable portion of the fire-damp existing in the cells and pores of the coal would be expelled, and therefore the liability of explosion would be reduced by the quantity of fire-damp so driven off."

Whatever difference of opinion may exist as to the prevention of spontaneous combustion of coals in ships, there can be no doubt that explosions therein from coal gas can be prevented by systematic ventilation, if there are no cracks or openings in the holds or coal bunkers, whereby the marsh gas might escape, but not by the present system of attempting to ventilate coal cargoes by making a few holes in the deck and place therein pipes with the various kinds of cowls, which are liable to be carried off when heavy seas are shipped, and a great quantity of water cast among the coals. Mr. Rowan is also of opinion that "surface ventilation alone will not remove all the fire-damp that lodges throughout the coal in the holds. The same mechanical difficulties and conditions, as pointed out by Dr. Percy and Professor Abel, that prevent 'through ventilation' being carried out in coal cargoes, would also be present as regards the passage of the marsh gas from the lower portions of the cargo to the surface." We concur with Mr. Rowan that there is no limit to surface ventilation with respect to explosion; but there is the danger of spontaneous combustion by a currant of air passing over the surface of the coal being occasioned by carbonaceous oxidation, which we have previously referred to. He therefore properly states that while the surface coal gas should often be removed and replaced by pure air, particularly for a few weeks after the coal has been loaded, or in hot, or during, and after, rough weather, when there has been much motion of the coal on board. He thought "that it may be inadvisable to have currents of air passing continuously over the surface of the coal in the holds." The method recommended by him for preventing coal cargoes exploding are: "1st, the very frequent removal and replacement of the atmosphere from the surface of the coal (as stated above), by properly-placed abstractors and suppliers; 2nd, the employment of the abstractors throughout the coal-holds, to remove the fire-damp in the lower portion of the cargo; 3rd, the through ventilation, by means of suitably-placed abstractors and suppliers of the compartments adjoining and surrounding the coal-holds, to prevent lodgment of fire-damp, which may leak into them from the holds."

Nearly the same precautions should be adopted to prevent explosions in ships from stores containing volatile and inflammable substances, as those suggested for the removal of coal gas.

Several inventions have been patented in this and other countries for ventilating enclosed spaces in ships, which are more or less useful. After the tests they have been subjected to, it appears to us that the apparatus invented by Captain F. L. Norton, late of the United States Navy, is well worthy of a detailed description.

The invention consists of a water bell or air chamber, which, by steam-water engine or other motive power, is made to move up and down inside a circular iron tank, by a beam or other attachment, and the water forms the packing of the pump. There are two valves at the bottom of the tank, one of which is used as an exhaust and the other as a discharge valve. To the former a line of piping is connected, which extends to the full length of the ship, and to this branch pipes are attached leading to the state-rooms, cabins, lockers, coal bunkers, bilges, and under the ceiling of and other parts of the ship. By the motion of the water bell the air is continuously abstracted from every part to which a branch pipe extends, so that all the air of the ship is entirely changed hourly, and thus rendered quite pure, while the exhausted foul gases are discharged into the open atmosphere, where they are neither injurious to health or offensive.

The Norton Automatic Ship Ventilator, which is essentially designed for the ventilation of sea-going sailing vessels, is worked by the movement of the ship, and can therefore be efficiently used instead of the power ventilator. The apparatus consists of a copper-pipe or piston attached to the stern-post with which it is made to correspond in shape. A pipe passes from this into the stern of the ship, where it is attached to a pair of valves, similar to those at the bottom of the tank of the power ventilator, and the water in the pipe or cylinder falls as the stern of the vessel rises in the sea, thereby causing a vacuum, to fill which the air is drawn through the system of pipes we have mentioned. On the contrary, by the descent of the stern to the sea the water is raised by it in the cylinder, while the air previously drawn in from other parts of the ship is forced through the discharge valve into the open air. In a port or a calm, when there is no motion of the ship, ventilation can easily be effected by manual power, which can be supplied by a boy, and will be as serviceable as the automatic operation.

We are informed that it has been proved that with a rise and fall of a ship of only one foot, the automatic ventilator will abstract 5,000 cubic feet of air per hour, while the power ventilator, which can be worked with a donkey-engine, and occupying but a very small space (the engine-room being used as its receptacle), will pump out no less than 52,000 cubic feet of air per hour from different parts of the ship. The exhaust capacity of the ventilator is always made to correspond with the size of the steamship or sailing vessel to which it is to be applied.

The use of the Norton Ventilator, which is simple and strong in its construction, noiseless in its work, inexpensive as to cost and operation, and not liable to get out of order. It will materially improve the healthy constitution of every ship on which it is used, by its great power of abstracting contaminated air, and will, when properly applied, not only prevent spontaneous combustion of, and explosions from, coal in ships, and also explosions from the inflammable and volatile substances upon which we have commented, but will remove all danger of cattle suffocation, grain heating, tea sweating, and fruit rotting.

Captain Norton has had a sailing yacht called the *Ocean Pearl*, of 300 tons burden, built and ventilated upon his method, and which has been highly appreciated by all who have inspected the application of this system to her, and very favourably noticed in *Iron* of the 15th of October, 1880.

The apparatus has been applied with great success on the steamship *Warwick*, the latest addition to the Great Western Steamship line for service in the American trade, and a number of other ships; and several approvable notices in the newspapers have testified to the superior importance of these ventilators for exhausting foul air from ships; and we have every reason to believe that they will be much required, as all other systems appear to be quite inadequate for proper ship ventilation. Because, even if the cowls which are used in them are not removed from the apertures to which they are affixed, whereby the shipping of heavy seas in rough weather would cause a rushing in of large quantities of water in the receptacles, which these appliances are used to ventilate, none of these systems possess any approximating power to draw vitiated air from ships even in weather most favourable for them to do so, while in calm weather they appear to be productive of no appreciable results. On the other hand, the Norton ventilating system will operate equally well on all occasions, and is, therefore, at the present time, the only one that can safely be depended upon for efficient ship ventilation.

We may also add, that the Norton ventilators are not only designed for the ventilation of ships, but also for houses, churches, chapels, halls of audience legislation, assemblies, exchanges, courts of justice, school-rooms, hospitals, prisons, workhouses, asylums, theatres, music-halls, banks, offices, stables, tunnels, and mines; and all enclosed spaces can be thoroughly ventilated and freed from foul air.

His system has been used with great efficiency in the Criterion Theatre in London, after the use of other ventilators had failed, and now this theatre is one of the best ventilated buildings in the United Kingdom. The Norton ventilating apparatus has also been productive of equally appreciable results at the State House, Massachusetts, and the Boston Stock Exchange; but its most important application, on a large scale to public buildings, is the Chamber of Representatives at Brussels, in which several other ventilating systems, which have been applied therein for more than forty years, have all failed. The application of the Norton ventilation apparatus to this magnificent edifice has been a brilliant success, and strongly commended at great length in one of our principal Belgian newspapers. These and other splendid results which have followed from the use of Captain Norton's system, and which far exceed any other power or automatic means of ventilation for buildings or ships, are calculated to cause his ventilators to be extensively adopted, as they well deserve to be, for the numerous purposes for which they can be applied.

We have been informed that the Norton Ventilator will be applied very shortly to several of our London theatres, large underground restaurants, and also to a number of steam and sailing ships in the Eastern trade.

(*To be continued.*)

WITHIN the past month a new feature has been added to the shipbuilding enterprise of the North-West of England, by the marking off of a course for speed-trials of steamers. At the instance of the Barrow Shipbuilding Company, the authorities of the Furness Railway Company have been induced to measure out the required distance opposite the little watering-place of Seascale, on the Cumberland coast, where their property reaches to the sea, and the ends of the course have been marked by prominent landmarks. Hitherto on this coast trials of speed have mostly been made over longer distances, such as to the Isle of Man, or, in cases where accuracy was of greater moment, the vessels were obliged to be sent all the way to the well-known course between the Cloch and Cumbrae Lighthouses, on the Clyde. In future reliable results will be obtainable from trials nearer home.

PATENT CORRUGATED METALLIC JOINTING.

SOME of the methods in ordinary use for making steam and water joints in marine or other engines and boilers, or in hydraulic machinery, or in using compressed air, or other elastic or non-elastic fluid or gas offering great resistance, has been to place between the flanges or joints a piece of sheet lead, or lead wire, pasteboard, felt, or other pliable materials, coated with red or white lead. In many instances when such material has been used, although enormous pressure has been brought to bear on the flanges of cylinders, steam-pipes, &c., in order to render the joint thoroughly tight, some very small irregularity in the required evenness of the surfaces has been the cause of a leak. Such leaks as these have caused great loss of time, and an endless amount of trouble before they could be rectified. Vulcanised indiarubber, and other soft and elastic material has been extensively applied, but still the greatest difficulty has existed to ensure a tight, and beyond all durable, joint. This is only to be accounted for by the fact that the packing in ordinary use is made with a smooth and even surface, and when used, especially in very large joints which also has even surfaces, will not give enough under pressure to force the packing into the smallest unevenness existing in the surfaces of the flanges. The Patent Corrugated Jointing Company, 75, Gracechurch Street, London, E.C., have, after studying and testing this speciality, brought out a metallic packing which fully answers every required purpose. By this invention the packing is formed of strips of soft lead, or alloy of lead, or other sufficiently soft and pliable metal or material, each such strip being formed of a shape in transverse section, consisting of two or more bars of square, circular, or other convenient shape, connected together at or about the centre of their diameter by a continuous thin web. If, therefore, continuous strips of material of the section described be placed between the surfaces where the joint is to be formed, and these surfaces are then screwed, or otherwise forcibly drawn together, the lead or other material is flattened or compressed, first at the upper and lower edges only of the component wires or bars with comparatively little pressure, whilst where any irregularities exist, or where very great pressure has to be resisted, the wires or bars are still further compressed and flattened upon their edges, making a tight joint with much less pressure than where a flat strip or surface only is used, instead of the compound or corrugated surface described. In cases where it is found advisable to use white or red lead, or other plastic cement upon the joint, it is retained when spread upon the corrugated metal strips in the spaces between the wires or bars, and is thus prevented from squeezing out and becoming useless, when pressure is applied to tighten the joint. It will also be seen that by the use of corrugated metal strips, the considerable thickness of lead or other material is obtained in a form which can be easily bent and compressed into any shape. They can also be easily cut between the wires or bars into any required width.

Metallic strips of this construction may be used for the purpose of strengthening flexible hose pipes used for the conveyance of water or other fluids, the strips being wound helically round, either inside or outside, or in the substance of such flexible pipes.

ELECTRICITY AND ITS MODERN DEVELOPMENTS, WITH SPECIAL REFERENCE TO MARINE ENGINEERING.

(*Continued from page 233.*)

AT the close of our last article, we expressed a hope that we should be able to illustrate the present one with plans of the lighting arrangements of one of H.M.'s troopships, then being fitted by the Swan United Electric Company, Limited. We regret that, owing to the late date at which the Admiralty trials took place, we are unable in the present number to realise this hope; but we are able to describe and illustrate the method adopted on some of our first ocean steamships. On page 117 of our August issue, we referred briefly to the Incandescent lamp, and but little further description is here necessary. The form and appearance of these lamps and their light are well known to every one; the illumination they afford is comparable in amount to the gas-jets or lamp-flames with which we are familiar. The facility with which the light can be subdivided and placed in confined situations, or small apartments, renders them invaluable, where an Arc lamp would be simply intolerable. Further, absolutely no regulation is requisite; the construction is as simple as that of an ordinary burner, with the additional advantage that no match or light is required to start it into action. There is, indeed, absolute safety, as the breakage of a lamp involves *ipso facto* its immediate extinction. These points constitute valuable recommendations for domestic and general lighting—recommendations which are intensified on board a steam-vessel. Here the lamps can be fixed where oil lamps, owing to their heat and smoke, could not be placed, close to roof, wood-work, &c. They give no smell, and scarcely any heat, and have the enormous advantage of not flickering when exposed to draughts. The absence of smell is also of great importance in the engine-rooms, a hot bearing being at once detected by the smell of burning oil, which would pass unnoticed were the room lighted with the usual flaring oil-lamps. Nor must it be forgotten that the difficulty of production, and the great danger both in distribution and combustion of gas, practically exclude it completely from employment on board vessels. Here, then, electricity no longer has to contend with its doughtiest champion.

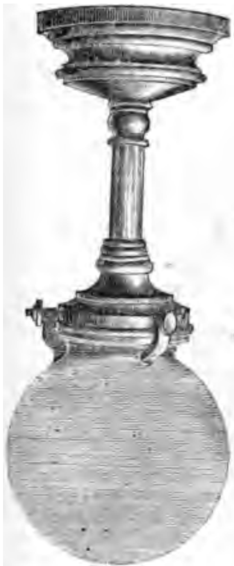


Fig. 1.

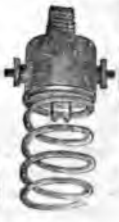


Fig. 2.

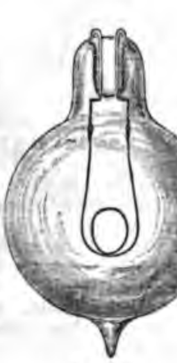


Fig. 3.

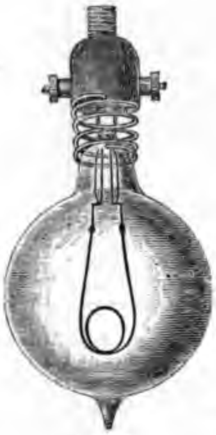


Fig. 4.

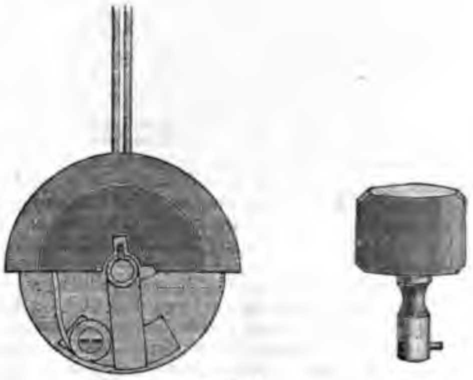


Fig. 5.

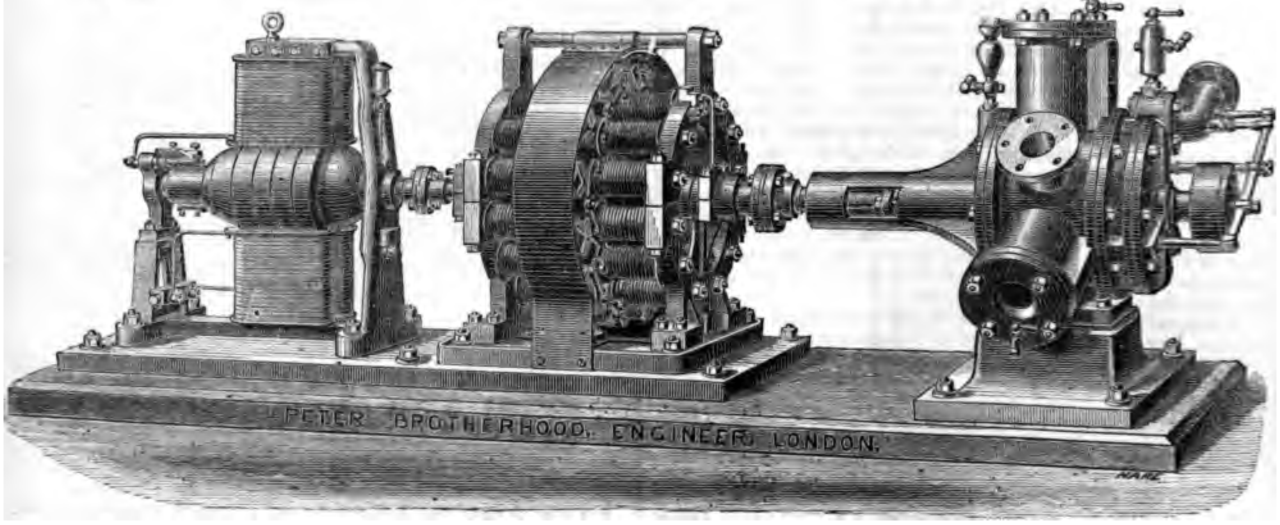


Fig. 7.

For generating the electricity supplied to Incandescent lamps, apparatus is employed similar to that already described for Arc lights. The differences are too technical and scientific to admit of discussion, or even statement, in an article so general as the present. We therefore proceed without further delay to describe the practical methods adopted by the Swan Company, who have made this branch of the business peculiarly their own.

The first vessel on which the light was installed was the s.s. *City of Richmond*, of the Inman line, in June, 1881. Since that time the system has been applied to over twenty of our largest ocean liners. On the *City of Richmond* the electricity is generated by a Siemen's Alternate Current Machine, driven by an ordinary horizontal engine, placed in a small room adjoining the main engine-room, and supplied with steam from the main or donkey-boilers. From the generator two insulated main leading cables run to the saloons, &c., the lamps being placed in branch circuits, forming bridges, as it were, between the main-cables. Sixty lamps are installed, forty-eight being in the saloon, hung in pairs in plated pendants with obscured globes. (Fig. 1.) The lamps in the passages are suspended from brackets. The lamps are attached to the pendants and brackets by the ingenious holder shown in Figs. 2, 3, & 4, which, while preserving perfect contact, allows sufficient movement to prevent the lamp being affected by the vibration of the ship. Where the branches are attached to the cables, are placed switches, of which one is shown in Fig. 5. By this device the lamp can be turned off or on at the discretion of the steward, who possesses a peculiar key, so constructed that it can only be removed from the switch when the latter is turned fully off or fully on, thus preventing sparking. A safety fusible plug-connection is provided for each switch, so as to obviate any risk of fire. Occasionally, where it is inconvenient, from exigencies of position to attach the switch,' a safety-fusing plug-bridge (Fig. 6) is employed, the plugs being made of steatite

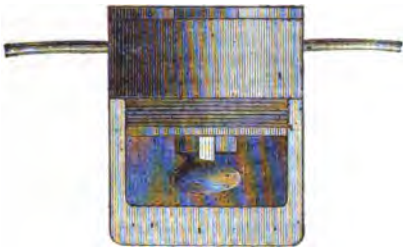


Fig. 6.

and the fusible connection consisting of a strap of tin-foil stretched over the plug and pressed by it against each pole of the switch. Should from any cause an overplus of electricity be turned into the branch, the connection fuses, the current ceases, and any risk of danger vanishes. These details apply to all the steamers.

The s.s. *Servia*, of the Cunard Line, is fitted with sixteen lamps on the promenade deck, sixty-two on the spar-deck, twenty-two on the main deck, twenty-three in the engine-room, and fifteen in the stoke-holes, in all 138. There are also two Arc lamps with flexible leading-wires for suspending over the hatches when loading or unloading. The Siemen's Generator in this case is driven by a Brotherhood's high-speed, three-cylinder engine, mechanically coupled to the machine (Fig. 7). This arrangement is coming much into favour with electricians, as the frequent irregularity of belting or gearing, and the consequent unsteadiness of the light are avoided. Much less space is also occupied.

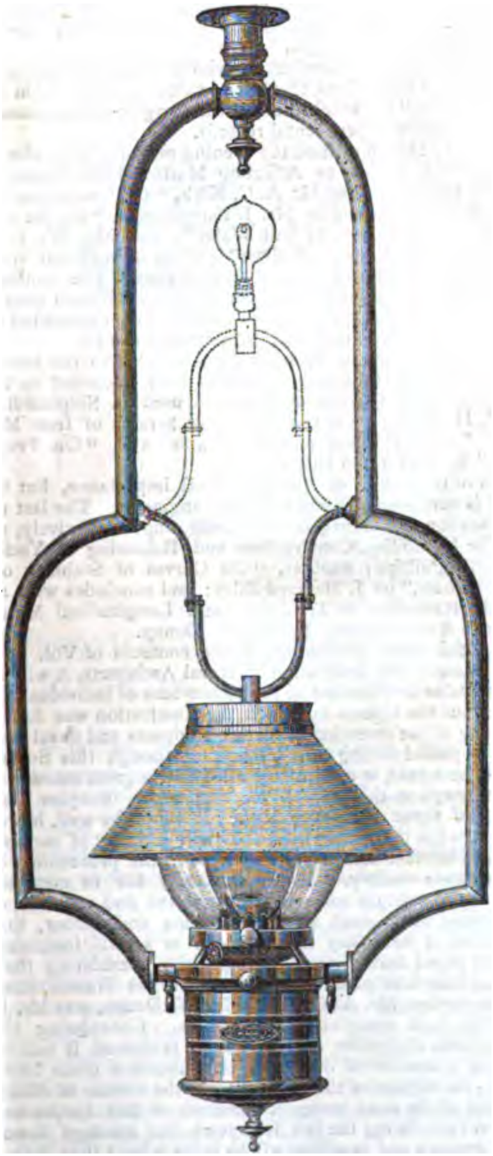


Fig. 8.

The sister ships of the White Star Line, s.s. *Coptic* and *Arabic*, have each an installation of 135 Swan lamps. 27 in the saloons are attached to the oil-lamp fittings (Figs. 8 & 9), where the dotted lines represent the Swan bulbs turned up by a swivel arrangement, so as to be out of the way should resort be had to oil. For the state-rooms, bath-rooms, &c., the lamps are placed in the usual triangular lanterns, each lighting two cabins and a portion of the passage; two portable pillar lights are employed in the chart-room, and the engine-rooms and stokeholes possess 22 in ordinary lanterns. In each of these vessels two small alternate current machines are used, each capable of sustaining eighty lamps, and both driven by a double-cylinder horizontal Tangye engine, connected up with counter-shafting and belts.

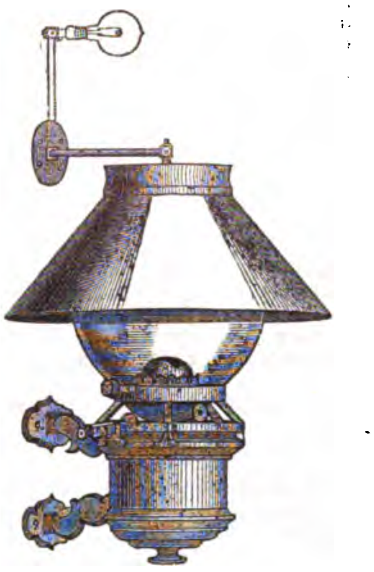


Fig. 9.

The s.s. *Manapouri* and *Wairarapa*, of the Union Steamship Company of New Zealand, have each 145 Incandescent lamps and two Arc lamps. The arrangements of engine and dynamo are similar to those of the *Servia*, while the lamps are affixed. In these pendants also the Incandescent lamp can, by a swivel arrangement, be turned out of the way when the oil lamp is lighted.

The Cunarders, *Cephalonia* and *Pavonia*, possess each the large number of 320 lamps, distributed over all parts of the vessel. The electric current is supplied by two generators driven by Brotherhood engines.

In addition to these vessels, the following are lighted by the Swan Company's lamps :—

s.s. *Chimborazo*	Orient Line.
,, *Orient*	
,, *Cotopaxi*	
,, *Austral*	
,, *City of Rome*	Anchor Line.
,, *Alaska*	Guion Line.
,, *India*	British India Line.
,, *Ghoorka*	
,, *Reva*	
,, *Antonio Lopez*	Compania Transatlantica.
,, *Invicta*	L. C. and D. Rail. Compy.
,, *Faraday*	Messrs. Siemens Bros.
,, *Lonsdale*	
H.M.S. *Himilaya*	

In carrying out the installation on board the ill-fated *Austral*, Messrs. Siemens Brothers, the contractors, introduced some elaborate precautions against any possible break-down of engines and machinery. The scheme for the vessel comprised nine Arc lamps and 170 Swan lamps. Five of the Arc lights were placed on the engine-room, and four on the deck over the hatches. The Incandescent lamps are arranged upon two sets of conducting wires, each set being supplied with electricity by a separate steam-engine and generator. Ordinarily, each engine drives its own generator; but should one engine break down, the other can be coupled up, and has power sufficient to drive both dynamos. In each of the principal saloons and passages part of the lamps are supplied from the first pair of leading wires, and the other part from the second pair; so that, were an accident to happen suddenly to one engine, only half the lamps would be simultaneously extinguished. The vessel, further, is divided into sections, each with a distinct set of branch-wires and keys, so that the lamps in any section may be turned off independently. The fusible bridges are of course also inserted in the path of the current. In some of the passages, and other parts, a few lamps are connected at intervals to the main leads, and thus are not controlled by the sectional keys. These lamps burn all night, affording sufficient light for easy locomotion.

We believe, when we consider the safety and luxury ensured, no passenger-steamer, at least, will be deemed complete without the electric light throughout; just as no modern man-of-war is considered fully equipped unless provided with Arc lamps for purposes of defence and offence alike. In taking leave of this branch of our subject—Lighting by Electricity—we trust we have not only impressed our readers with the importance of the subject, but afforded them the materials for understanding in a general and practical way any modification of it which may be brought under their notice.

Review.

Transactions of the Institution of Naval Architects, 1882.

The opening address delivered by the Right Honourable the Earl of Ravensworth, at the twenty-third session of this institution, and published in the Volume of Transactions of 1882, shows the great interest taken by his lordship in all matters coming within the scope of the objects aimed at by this representative marine body, and stamps him as most worthy to fill the office of president, which was so long held by the Right Hon. Lord Hampton, K.C.B., &c.

Before making any observations on current shipbuilding and engineering topics, the Right Hon. President expressed the deepest regret at the absence, through ill health, of Mr. Scott Russell, with the hope that he might soon be restored to his usual vigorous health, which hope, our readers well know, was not to be realised, as this celebrated engineer and shipbuilder died on June the 8th, 1882. The president then proceeds to notice the marvellous progress in marine engineering and shipbuilding in this country, amongst other remarks, showing the necessity for economy in the uses of fuel, and from statistics quoted, prove that from 1863 up to 1882, no less than 75 per cent. had been saved in the consumption of coal by means of improved marine engines and boilers. The promising state of trade, and the vast increase in the size of our merchant vessels, was next commented upon, and the able address concluded with a digest of the views of Mr. W. Denny as to the merchant vessel of the future, and of Sir W. Armstrong's ideas of the war-ship of the future, the former set forth in a paper read at Greenock, the latter in the presidential address to the civil engineers in January, 1882.

The actual business of the institution then commenced, and as accorded in the vol. before us, the two first papers contributed were—1st, "Armoured Ships and Modern Guns," by J. D. A. Samuda, Vice President; and, "On Modern Merchant Steamers," by James Dunn. The first named paper entirely disposed of the most favoured illusions of Sir W. Armstrong, and was most warmly agreed to and supported by many prominent members in the discussion which followed. The succeeding paper, on the other hand, endorsed the ideas of Mr. W. Denny, and of those who took part in the discussion. We can recommend a perusal of the researches and applications of improvements to merchant vessels as recorded by these gentlemen to all shipmasters and captains interested in the question as to "Why Cargo Steamers Founder," and also call their attention to the improvements which are continually studied and carried out by shipbuilders and ship surveyors to ensure the safety of vessels of all classes.

The first day's meeting was brought to a close with a most valuable paper by Mr. A. C. Kirk, "On the Triple Expansive Engines of the s.s. *Aberdeen*"; and another by W. Parker, "On the Economy of Compound Engines. These important and valuable papers with the added remarks obtained in discussion, have been, as far as possible, published in the back numbers of the Marine Engineer on account of the direct manner in which their contents applied to the requirements of the marine world. In addition to the high tone of these papers and the discussions thereon, the accompanying plates of illustrations drawn up by Mr. Kirk and Mr. Parker, are most exhaustive and invaluable.

Mr. W. H. White, Chief Constructor, Admiralty, opened the next meeting with a paper, "On the Revision of the Tonnage Law." Mr. White must have trespassed considerably on the limit of twenty minutes, the time to which the reading of an ordinary paper is confined, if we judge by the space this occupies in the volume; it is to be presumed that the great importance attached to this subject, and the able manner in which it was handled by the author, made amends for any amount of time devoted to it. The discussion was again carried to a great length, and contains the opinions of the best authorities in the kingdom on tonnage measurement and laws.

This is followed by a paper "On the Basis for Fixing Suitable Load Lines for Mercantile Steamers and Sailing Vessels," by Mr. B. Martell, Chief Surveyor to Lloyd's Registry. As might be expected, this subject excited as large an amount of interest as the preceding paper, and the discussion which followed was warmly carried out to a great length.

Mr. W. Denny, of Dumbarton, who had taken an active part in the foregoing discussions, then read a valuable paper "On Launching Velocities," by which the Institution again gains a most useful addition to their experimental records.

Mr. J. T. Milton opened the evening meeting with the subject of "Lloyd's Rules as Affecting Marine Boiler Construction." Next on the list we find Mr. A. C. Kirk, "On Cracks and Annealing of Steel"; followed by Mr. J. Farquharson, "On the Corrosive Effects of Steel or Iron in Salt Water"; and Mr. W. J. Norris, "On Corrosion in Steam Boilers." Want of sufficient space will not allow of a notice of each of these papers. The names of the authors and the subjects chosen by them is a sufficient guarantee of the value of the same, and this is considerably augmented by the various discussions which each subject gave rise to.

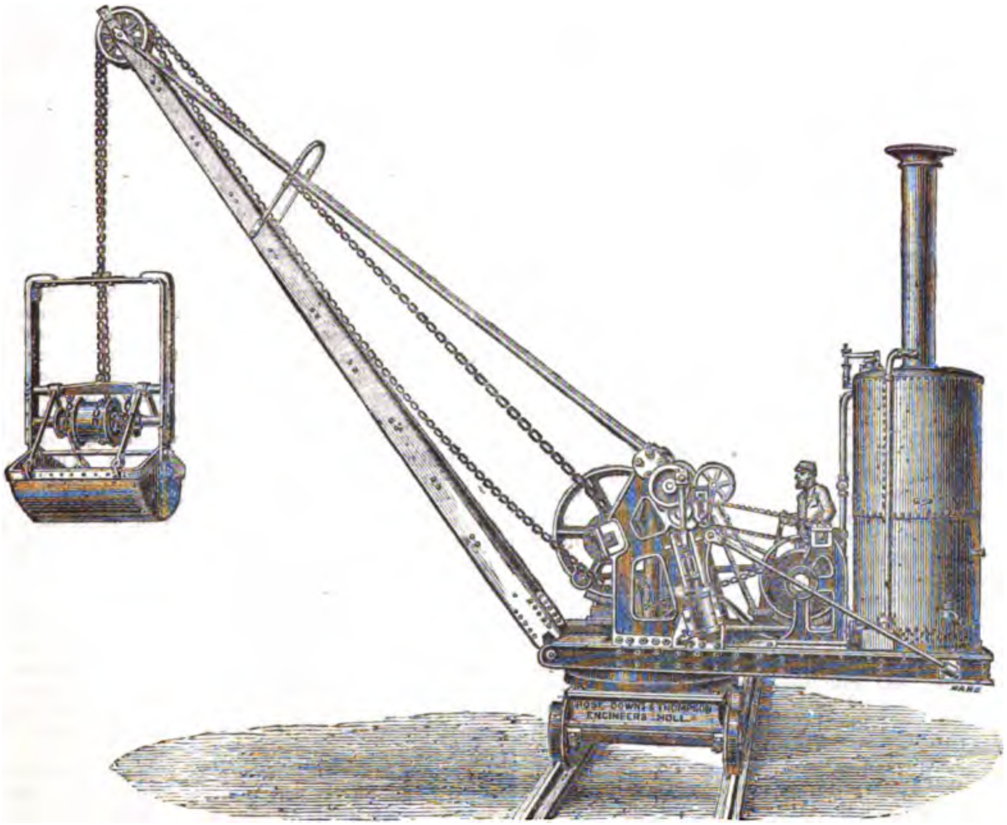
The next meeting of the session was devoted to the hearing and discussion of the following papers as fully recorded in Vol. 23, viz.:—"On the Quality of Materials used in Shipbuilding," by Mr. H. H. West; "On the Transverse Strains of Iron Merchant Vessels," by T. C. Read and P. Jenkins; and, "On Progressive Trials," by J. Harvard Biles.

Each of these were of the most vital importance, but the last named is particularly useful to marine engineers. The last meeting of the session was engaged in investigating respectively, a paper "On the Durability, Construction, and Ballasting of Yachts," by Mr. B. T. Phillips; another, "On Curves of Stability of some Mail Steamers," by J. Harvard Biles; and concludes with a paper "On the Reduction of Transverse and Longitudinal Metacentric Curves to Ratio Curves," by Mr. W. Denny.

From this brief description of the contents of Vol. 23 of the Transactions of the Institution of Naval Architects, it will be seen that the value and interest of the endeavours of individual members to carry out the objects for which the Institution was founded, is as worthy of the attention of marine engineers and naval architects as at any period during their history. Although this Society only meets once a year, it cannot be denied that a great amount of work is got through at this annual meeting which occupies the larger portion of three successive days. It would be well, however, to notice here (as in former years) the great majority of members and associates interest themselves very little in the proceedings of their representative society. It seems hardly fair to members who repeatedly contribute subjects of experiment and research, only to be obtained by a great sacrifice of time and labour, that they should find it necessary to contribute in several instances more than one paper during a session, especially considering that these meetings only take place once a year. In the Transactions of last year we see that Mr. A. C. Kirk, Mr. W. Denny, and Mr. J. Harvard Biles, each contributed two papers. Considering that the contributions altogether only numbered seventeen, it will be seen that from a number of over 600, only fourteen came forward to support the objects of the Institution at the session of 1882.

Several of the most energetic members of this Institution have been lost to it during the last few years, but amongst these none whose presence and exertions will be more missed than those of the late Mr. J. Scott Russell, to whom as one of the four original founders of the Institution, the greatest credit is due from his unceasing endeavours to promote its interests and objects most unremittingly during a period of twenty-two years.

It is to be hoped that the present generation will support the good work so long carried out by those who are retiring from the active list, and that the forthcoming Easter meeting of this Institution may be so largely supplied with papers of interest as to necessitate the holding of an adjourned meeting. It is a well known fact that a field of requirements large enough to necessitate a meeting of Naval Architects and Marine Engineers every month exists in our Mercantile and Royal Navies, and it remains to be seen at the next session of this Institution, if shipbuilders, owners, surveyors, &c., are as keenly alive to their owns interests as the members of most other kindred societies.



SELF-ACTING GRAB AND BUCKET DREDGER.

THE KINGSTON SELF-ACTING GRAB AND BUCKET DREDGER AND EXCAVATOR.

THIS Machine, the patent of Messrs. Hodge and Thompson and made solely by Messrs. Rose, Downs and Thompson, Old Foundry, Hull; is mounted on a strong cast-iron foundation on wheels; the centre post is of wrought iron; the side frames are of cast iron, securely bolted to the bed plate and crosshead, with two cylinders fixed outside the frames. The hoisting and opening gear are frictional, and are put in and out of gear by eccentric motions; they are so arranged that the bucket or grab can be hoisted and lowered, opened and shut, by one man with the greatest ease. The machine is also fitted with powerful turning gear. The jibs are made of wrought iron on the lattice principle. The boiler is of the vertical type, made of steel, fitted with all necessary mountings and fixed on a feed tank.

The feed water is heated by the exhaust steam, and the feed pump is made specially large for pumping hot water.

The principle of the Kingston Dredger is shown in the illustration. On the platform of a strong steam crane is fixed Hodge's patent self-acting gear. This is shown near the boiler, and is driven by a pitch chain or other means from the crane, and to it is led the opening chain of the bucket or grab. The mode o operation is as follows:—The engine being started the driver by means of the hand wheel puts the swingin gear in motion to the right or left as the case may be. The grab or bucket being over its work is allowed to run down open, being perfectly controlled by a slight pressure on the brake lever on it striking the ground, the main chain barrel is thrown into frictional gear by the starting lever. The pull of the hoisting chain brings the jaws of the grab or bucket together before the frame, and centres on which they work, begin to rise, thus forcing them into the material to be lifted. When the bucket or grab is hoisted high enough the crane is swung over the place where the material is to be dropped, or, in the case of a locomotive excavator, the machine may be traversed on the rails either way.

To empty the bucket or grab, the brake is put on the self-acting gear by the opening lever, and the chain from the main barrel allowed to run out, this opens the bucket. The steam supply to the engine is under perfect control by the use of the leg valve, and the pressure and water gauges of the boiler are so placed as to be under the observation of the driver. In this machine Hodge's Patent Self-acting Gear does away with the necessity of weights and other means of taking up slack chain, the jarring of the hoisting chains on the jibs when the brake is applied is avoided, the brake and counter-shaft are applied to the main barrel by separate levers with very little exertion, and all the working parts can be got at for repairs without taking down the framework. The cranes and machines may be placed on pontoon or barges for harbour and riverwork, steam crabs being used for warping the barge or pontoon to its work; they may also be made locomotive and used for all kinds of excavations on land. The buckets are made to lift and discharge, grain, coal, mud, ordinary clay, shingle, stiff mud, sand, stiff clay, fine sand, or blasting *debris* from 10 cwt. to 40 cwt. at one hoist as may be required.

Correspondence.

It must be understood that in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value, or as being calculated to promote such discussion as will elicit facts, valuable from their being the result of practical experience.—ED.]

DISASTERS AT SEA.

To the Editor of THE MARINE ENGINEER.

SIR,—The sinking of the Inman steamer, *City of Brussels*, by the steamer, *Kirby Hall*, off the Mersey, will probably call the attention of several maritime nations to the "fact"; that better protection, by the adoption of more adequate signals to be used in fog, mist, or snow, has been the long felt want since the first introduction of steam for propelling vessels.

When approaching each other in fog, vessels all sounding the same signal, no definite information can be had of the "direction" or course steered by either vessel. Refer to article 12 (a) International regulations for preventing collisions in fog, mist, or snow.

A vessel heading W.N.W. might sound at regular intervals in, fog, *short*, *long*, *short*, and call from any other vessel in close proximity a signal indicating her intended movements; then each would be able to notify the other of their intention to comply with the rule of the road.

A vessel heading east could make known the fact by a signal, *long*, *short*, *long*. Some are apt to say sound cannot be located in fog; referring to the *Times* of the 11th inst, the 3rd officer of the *Kirby Hall* first located the *Brussels* on the port bow. The chief officer of the *Kirby Hall* suggested the vessel making the signal was crossing the bow of his vessel. Supposing each had been sounding the course or direction his vessel was heading, the signal given by the *Kirby Hall* might have been *short*, *short*, *long*, that would have been definite information, and the officer of the *Brussels*, understanding a vessel on his starboard bow, steering about S.S.W., would have been safe to go full speed astern, bringing the bow of *his* vessel about N.N.E., and sound the signal *long*, *short*, *short*, each vessel would then be giving a signal quite the reverse of the signal representing the course the other was heading, the chances for collision would be slight.

Here we discover four distinct signals, representing the four principal points of the compass, either signal may be given with the utmost precision, and, instead of sounding one prolonged blast, as prescribed by Article 12 (a), we find the same length of time required to give this worthless blast occupied in giving a signal, bearing with it confidence to any officer in charge of a vessel in close proximity, that wherever the sounds emanate from there is a vessel heading on one of four clearly indicated points of the compass.

Referring to *The Daily Telegraph* of the 4th January, in which paper two columns were devoted to this subject, we find how collisions occur, oftentimes, by pedestrians on the pavement, owing to an indefinite understanding by each of the other's intended movements. Compare this "fact" with a case where two large steam vessels in fog are complying with Articles 12 (a) and 13. When the officer in charge gives the order to port, starboard, stop, full speed, ahead, or astern, he should know, with one degree of certainty at least, that the order given was based on intelligible information received, that a vessel giving a signal representing the line of danger over which he must not pass, being governed by the rule of the road, he gives the order promptly and with confidence, being assured of safety by so doing. Happily the loss of the steamer, *City of Brussels*, did not involve the loss of life that took place in November, 1878, when a similar large mail steamer went to the bottom in the English Channel after leaving Cherbourg, being run down by a barque. Since then four years have intervened and yet the steamer in fog, if moving, is supposed to give the same signal to-day for the guidance of others.

If the rule of the road is to define right of way, the International system of signals should be a language made up of long and short sounds, to enable each officer in charge to communicate his intention to comply with the rules.

What assurance can one officer have that his presence is known by the officer in charge of another vessel, when lights are first seen? Collisions do not all occur in fog, this "fact" is substantiated in the case of the *Druro* and *Yurac Bat*.

The regulations for preventing collisions at sea, embody right of way by rule of the road, and should embody a language of sounds to be used in fog, and a system of signs for use when the lights can be seen. The Trinity house have adopted high and low sounds to indicate which lighthouse vessels in fog are approaching; therefore the sounds used for indicating the course steered should be long and short, preventing all chance for mistaking one for the other. Some large steam vessels will produce sound from a steam fog horn, quite as loud as some of the lighthouse signals.

Wherever the "sailing vessel" is to be found the steamer is likely to be also. If by rule of the road the steamer is to go clear of the sailing vessel, no definite rule can be laid down for the steamer how she shall pass clear; that must depend on the judgment of the officer in charge, but the regulations for preventing collisions may instruct the officer in charge of the steamer to notify the officer of the sailing vessel to keep a steady course, and, in return, the signal from the sailing vessel might easily convince the other that he was holding a steady course. The sailing vessel on the port tack must pass clear of the sailing vessel on the starboard tack, the only indication to the vessel on the starboard tack that the vessel on the port tack will keep off, under the present regulations, is to wait for her bow to hide the green light by swinging off; much anxiety and suspense might be done away with by a sign or signal from the green light in question.

Any vessel, continuing steadily on her course, should exhibit at night a steady red and green light, that is to say, side lights, properly placed, showing a clear unbroken light over an arc of ten points of the compass, from right ahead to two points abaft the beam, and when surrounded by fog in the presence of any vessel, who, by rule of the road, is supposed to clear her, should repeat her fog-signal, giving the course steered oftener at shorter intervals than when she presumed the road to be clear.

The officer in charge of a vessel, who must pass clear on sighting the red light on his port bow, or hearing the fog-signal from a vessel moving steadily on her course, would then be better able to say how he would pass clear by giving a signal; much valuable time would then be saved, especially where the sailing vessel is crossing the path of a steamer. We may theorize on the probability of one vessel passing clear of another by placing them in position on paper. Were every vessel to be built on the same lines, and all the same length, some would be likely to answer the helm more readily than others. The officer in charge knows better than anybody what his vessel will do, therefore his judgment must be relied on to a great extent, when meeting vessels in fog or at night.

The responsibility of giving the order to port or starboard the helm, where vessels are meeting or crossing is great, it either means safety or destruction to property, and oftentimes loss of life, therefore anything that can be provided to assist in preventing collision at sea will be received with gratitude by the travelling public.

W. B. BARKER.

62, Holborn Viaduct.

To the Editor of THE MARINE ENGINEER.

STEAMER "THORNHILL," OF LONDON.

DEAR SIR,—Thinking the following facts might interest some of the readers of your valuable paper, I send them for insertion.

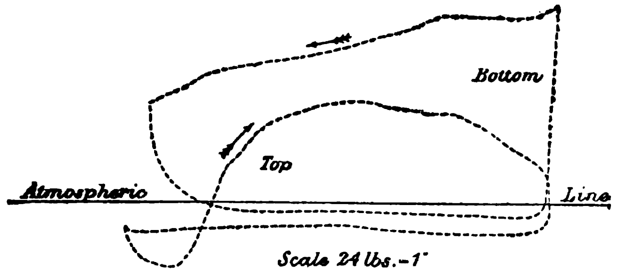
While on a voyage from Mobile, U.S., to this port *via* Cape Breton, and off the coast of Nova Scotia, on the 6th inst., we experienced a severe frost, reducing the temperature of the sea by evection or evaporation, the surface being in a state of effervescence causing a dense fog, varying from one to fifteen feet above its surface, according to the wind. This, together with the spray blown into the sockets supporting boat davits, had frozen gradually in the bottom, and imperceptibly forced the davits two inches up; two of the davits, in addition to their own weight, suspended a boat with equipment for immediate use. The sockets are three feet deep, a small hole in the bottom for drainage, the ends of the davits convexed, and only those which had a slight vibrating motion were forced up. Icicles also formed round the top of waste steam-pipe. The rigging and ship sides were coated with ice to the water's edge, where it was four or five inches thick; snow had drifted under the funnel stays, remaining on the windward side against the funnel, the ship under steam the while; the temperature of the sea some fourteen feet below the surface was 34° Fahr. Probably nothing wonderful to the scientific—only demonstrating physical laws—but, nevertheless, interesting to Yours truly,

John Waddle,
Liverpool, Jan. 21, 1883. Chief Engineer.

To the Editor of The Marine Engineer.

DEFECTIVE H.P. CYLINDER DIAGRAMS.

Sir,—Owing to the long passages which many of our Ocean-going steamers have now to make to foreign ports, little time is given the engineer of the ship to examine the different details in the intermediate ports. There are many engineers who have taken off high press. cylinder diagrams, but few have had the opportunity of obtaining one similar to the tracing above. Valve was of the double D type, travel 8¼ in. The cause of defect was the "nut" of top of valve spindle being slackened back ⅞ of an inch. The accompanying diagram was taken off with the throttle valve nearly closed.

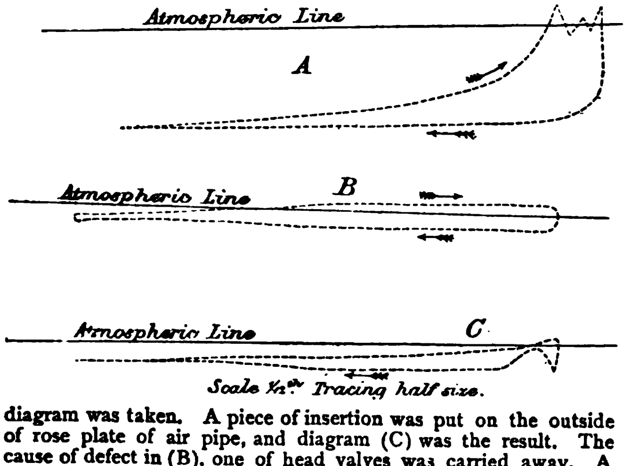


I am, Sir, yours truly,
J. R.
Shanghai, 11-82.

To the Editor of The Marine Engineer.

DEFECTIVE "AIR PUMP" DIAGRAM.

Sir,—The diagram (A) was taken off an air pump at the beginning of voyage. Vacuum 24 in., but shortly afterwards something wrong with "head valves" was suspected, took diagram (B) and the decrease of vacuum on gauge was only 1 in. when latter diagram was taken. A piece of insertion was put on the outside of rose plate of air pipe, and diagram (C) was the result. The cause of defect in (B), one of head valves was carried away. A diagram, similar to (B), would be got off an air pump with all "head valves" removed, with a slight increase in discharge line above the atmospheric line.



I am, Sir, yours truly,
J. R.
Shanghai, 11-82.

SHIPS BUILDING.

(*Continued from page* 273.)

Last year 18 vessels of 19,833 tons gross, were launched at Dundee. Seventeen vessels, registering 23,070 tons, are now contracted for by several firms; last year at this date orders had been received for 19 ships, of 24,058 tons. There is thus a decrease on order to two vessels, or 998 tons. A noticeable feature in the annexed list is the large proportion of "steel" vessels launched from and on the stocks in the different yards. In 1881 one large steamer, the *Merton Hall*, constructed of this material, was launched; but this year one steamer and three sailing ships, aggregating 4,604 tons have been turned out. Of the seventeen vessels now on the stocks, nine—eight steamers and one sailing vessel—are being built of steel, their tonnage amounting to 13,960 tons. Sailing ships still continue to be built, all the vessels launched by the Messrs. Stephen being of that class, while Mr. Thompson is fitting out the *Dundee*, the largest sailing ship ever constructed at this port. The Messrs. Gourlay are building a steel steamer, also to be named the *Dundee*, for the Dundee, Perth, and London Shipping Company. Coming to the work of the individual firms, we find that Messrs. Gourlay Brothers & Co., have launched five vessels of 6,983 tons, and have on hand seven of 13,150 tons. *Peveril* s.s. (steel), about 3,020 ton gross, 320 h.p., for Messrs. Williamson, Milligan, & Co., Liverpool. No. 116 s.s. (iron), about 3,570 tons gross, 350 h.p., for Messrs. Alexander & Radcliffe's "Hall Line," Liverpool. *Dundee* s.s. (steel), about 1,580 tons gross, 360 h.p., for the Dundee, Perth, and London Shipping Company. *Islay* s.s. (steel), about 1,100 tons gross, 110 h.p., for the North Sea Steamship Company, Dundee. No. 119 s.s. (steel), about 1,280 tons gross, 140 h.p., for Mr. Charles Barrie, Dundee. No. 120 s.s. (steel), about 1,250 tons gross, 210 h.p., for the General Steam Navigation Company, London. No. 121 (iron), about 1,350 tons gross, 160 h.p., for Senor Lister, Valencia. Mr. W. B. Thompson has built five vessels registering 5,813 tons, and has orders for three of 4,040 tons. Steamer (iron), 1,520 tons gross, 140 h.p., for Messrs. D. Scott & Son, Dundee. Steamer (steel), 1,260 tons gross, 120 h.p., for Messrs. P. M. Duncan & Son, Dundee. Steamer (steel), 1,260 tons gross, 120 h.p., for Messrs. P. M. Duncan & Son, Dundee. From Messrs. Alexander Stephen & Sons' yard five vessels of 5,087 tons were launched and this firm has on hand two vessels of 3,210 tons. New steel sailing ship, 1,770 tons register, for Dundee owners. New steel steamer, 1,440 tons register, 150 h.p., for Dundee owners. Messrs. Pearce Brothers have turned out three vessels with a tonnage of 1,950 tons, while five, registering 2,670 tons, have been contracted for. *Viking* s.s. (iron), 450 tons gross, 60 h.p., for Western and Brazilian Telegraph Co., London. No. 5 s.s. (iron), 400 tons, 60 h.p., for Messrs. Robert Thomson & Co., London. No. 6 s.s. (iron), 400 tons, 60 h.p., for Mr. Robert Taylor, Dundee. No. 7 s.s. (iron), 320 tons, 70 h.p., for Mr. Abraham Sutton, Cork. *Auckland* s.s. (iron), 1,100 tons, 120 h.p., for Mr. Geo. Hannay, Newcastle.

The number of vessels in course of construction in the yards on the Clyde aggregate 135, or two more than at the close of November. As contrasted with the vessels on hand at the end of 1881, there are at present only two vessels fewer. Of these, 25 are about ready, 37 plated, 53 in frames, and 20 keels laid or being laid. Amongst the more important contracts at present on hand, there is a third warship building by R. Napier & Sons for the British Government. Messrs. Donald Currie & Co., of London and Leith, have four large steamers of 4,270 tons each building for the Cape Mail service, two by Elder & Co., and two by Barclay & Curle: and one of 1,600 tons for the Leith and Hamburg trade, by R. Steel & Co.—in all, 18,700 tons. The Clan Line are getting four steamers of about 4,000 tons each built, two by Scott & Co., and two by Napier, Shanks & Bell. The Scottish Oriental Steamship Company, of Glasgow, have two steamers building by J. Elder, & Co. The British and African Steamship Company have two vessels building, one by J. Elder & Co., and the other by D. J. Dunlop & Co. The British India Steam Navigation Company have three steamers building, of 2,300 tons, by Messrs. Inglis. David Caw & Co., Glasgow, two steamers of 2,000 tons, for the West Indian trade, by J. & G. Thomson. Messrs. Alexander & Radcliffe, two Hall liners of 3,000 tons each, by the London and Glasgow Company. The Anchor line have two steamers of about 5,000 tons each building by D. & W. Henderson. The Guion line are getting a steamer of 7,300 tons built by J. Elder & Co. The National line one of 5,500 tons, by J. & G. Thomson. The Dominion line one of 5,000 tons by Connell & Co. The Union line one of 4,500 tons by Aitken & Mansel. The Glen line a steamer of 4.000 tons by the London & Glasgow Company. Raggio & Co., Genoa, have three steamers of 2,250 tons each building by Blackwood & Gordon. M. Frassinette & Co., Marseilles, two of 2,500 tons each, by A. M'Millan & Sons. A new Italian firm two of 3,000 tons by R. Napier & Sons. A British Mexican firm have six steamers building in the lower districts. The Amazon Steam Navigation four vessels of 500 tons each. The Bramapootra Steam Navigation Company three paddle steamers by Russell & Co. Several vessels are building for, Australian firms. There is also a large number of sailing vessels for Glasgow, Greenock, Liverpool, and London firms building and on order; and a fair number of steam yachts, dredging plant, and barges are in progress of construction.

Messrs. Ramage & Ferguson, Leith, launched during the past year a total of nine vessels—four screw-steamers, one sailing barque, and four steam yachts—aggregating in all 12,100 tons. Messrs. S. & H. Morton & Co. launched three screw-steamers having a total tonnage of 4,052 tons.

Messrs. Dobson & Charles, Grangemouth, built in 1882 three steel and two iron steamers, of an aggregate horse-power of 395, and registering 3,015 tons.

Messrs. J. Key & Sons, Kinghorn, Kirkcaldy, have launched during the past year three steamers, registering together 6,143 tons and 760 horse-power.

Although the return from Messrs. Hodgson, Soulsby & Co. of Blyth, for 1882 shows a decrease of two vessels, there is the large increase of 3,526 tons and 345 horse-power. The average tonnage of the vessels launched by them in 1881 was 783 tons, and in 1882 it increased to 1,510 tons. The horse-power in 1881 averaged 85 horse-power each vessel, but in 1882 the horse-power has averaged 156 horse-power. During the past three years the business of the firm has more than doubled. In the screw-steamers launched in 1882 are the *Ealing*, 2,062 tons, 200 horse-power; the *Castlehill*, 1,840 tons, 200 horse-power; and the *Castlegate*, 1,840 tons, 200 horse-power—all of which are three-decked cargo steamers of the highest class. Another good steamer was the *Karaweera*, 1,477 tons and 170 horse-power, a full poop vessel for Australia. The firm are at present fully employed, and the year 1883 opens with a bright prospect for shipbuiling at Blyth. The total tonnage launched during the year by Messrs. Hodgson, Soulsby & Co., was 10,574, with engines of 1,115 horse-power. The Union Co-operative Shipbuilding Society put into the water two small vessels of, together, 251 tons.

The total tonnage built on the Tyne during the past year amounted to 207,708 tons. This represents 132 vessels and 24,107 horse-power of engines. The Tyneside shipyards have large orders on the books; it is stated that so numerous are the engagements on hand that it would be impossible to fix an order for a vessel unless at a long date. Palmer's Shipbuilding and Iron Company, Jarrow, launched 29 vessels with a tonnage of 60,219. This is an increase over last year of 10,000 tons. In the number of vessels, however, there is only an increase of two. The horse-power and engines are larger by 1,500. They have delivered 19 vessels, equal to 24,960 tons, during the current half-year. Messrs. Schlesinger & Co., of Wallsend, turned out nine vessels, whose gross tonnage amounted to 16,979, being an increase over last year of 4,413 tons. Messrs. Wigham, Richardson, & Co., Neptune Works, launched seven vessels, total tonnage, 16,408; increase, 1,076 tons. Messrs. Armstrong Mitchell, & Co., launched 18 vessels; total tonnage, 26,002; decrease, 2,204 tons. Messrs. C. S. Swan & Hunter, Wallsend, 10 vessels; total tonnage, 18,092; increase, 5,086. Messrs. J. T, Eltringham & Co., South Shields, 10 vessels; tonnage, 1,184; decrease, 434 tons. The Tyne Iron Shipbuilding Company, Wellington Quay, launched seven vessels; tonnage, 11,451; increase, 685. Messrs. Campbell, Mackintosh, Bowstead, & Co., Scotswood, five vessels; tonnage, 8,946; increase, 6,124 tons. Messrs. Hepple & Co., North Sheilds, three vessels; tonnage, 359; increase, 262 tons. Messrs. T. & W. Smith, North Shields, five vessels; tonnage, 6,519; increase, 3,354 tons. Messrs. Redhead & Co., West Docks, South Shields, 13 vessels; tonnage, 19,797; increase, 5,829 tons. Messrs. A. Leslie & Co., Hebburn, nine vessels; tonnage, 20,782; decrease, 2,257 tons.

Messrs. William Gray & Co., Hartlepool, have built a total of 21 iron steamers of unusually large tonnage, their total being 38,200 tons, as against 32,033 tons, for 17 ships, in 1881; whilst the horse-power with which they were supplied was 3,598 against 3,080. Messrs. E. Withey & Co. produced 12 vessels, as compared with 11 in 1881. Their total tonnage was 21,905, and the horse-power 1,975, and the size was, generally speaking, much larger. Messrs. N. Irvine & Co. have almost doubled the production of 1881, the total number being six, with a tonnage of 7,253 tons, and engines of 660 horse-power.

Last year there was built on the Tees 40 vessels, the total tonnage of which amounts to 65,048, as against 34 vessels in 1881, with an aggregate tonnage of 58,565. Messrs. R. Dixon & Co., Cleveland Dock Yard, Middlesbrough, far exceed their neighbours, having launched 18 vessels with a tonnage of 27,249, against a total tonnage of 25,036 in 1881. Messrs. M. Pearse & Co., Stockton, rank next. The have reached a tonnage of 17,696, against 15,971 in 1881. Messrs. Richardson, Duck, & Co., South Stockton, have built 16,182 tons, compared with 17,338 tons in 1881. Messrs. R. Craggs & Sons, Cleveland Slipway, Middlesbrough, have launched three vessels, with a tonnage of 3,921, as against one vessel of 220 tons in 1881. Messrs. W. Harkess & Son, East Slipway, Middlesbrough, have been kept very busy repairing all the year, and will launch a fine steamer of 2,000 tons this month. It is perhaps not too much to predict that 1883 will eclipse 1882 in tonnage built on the Tees. Certain it is that all the yards have orders which will occupy them for many months. The prospects of the trade are most satisfactory. Inquiries are coming to hand daily for steamers of all sizes. Many Italian, Greek, and Russian firms are in the market for large vessels. Steamers built on the Tees are usually engined by Messrs. Blair & Co , Stockton; Messrs. Richardson & Son, Hartlepool; and Messrs. Hawthorn, Newcastle.

In the port of Hull during the year 12 vessels have been turned out from the yard of Earle's Shipbuilding and Engineering Company, of a total tonnage of 16,649, with an aggregate engine-power of 1,910 horses; the largest vessel launched by them being the *Grecian Monarch*, of 4,363 tons and 500 horse-power.

Messrs. Thomas Turnbull & Son, Whitby, have issued a very satisfactory return. During 1882 they launched eight iron screw-steamers with a total tonnage of 13,048 tons, and a united engine-power of 1,110 horse-power, against five vessels with a united tonnage of 5,700 tons and 740 horse-power during 1881. The largest steamer built at Whitby during 1882 was the *Matthew Bedlington*, 2,216 tons and 180 horse-power.

The Whitehaven Shipbuilding Company, which now, it may be mentioned, is under the management of Mr. J. B. Palmer, brother to C. M. Palmer, Esq., M.P., has had a good year, having turned out four steamers with a tonnage of 4,344, and two iron sailing vessels representing 2,634 tons. In both of the above districts prospects for the future are encouraging.

A new and important enterprise was opened last year to give employment to large numbers of workmen in the town of Newport (Mon.), as well as to encourage the iron trade of the district. We refer to the iron shipbuilding carried on by Mordey, Carney & Co., at the dry docks. The first steamer built by this firm was launched on the 11th inst.; two other steamers will be immediately laid down, one in the berth lately occupied, and the other alongside. The firm has also executed some large repairing jobs.

During the year shipbuilding at Messrs. Williamson & Low's yard, at Workington, has been vigorously pursued. According to the annual returns, it appears that there have been built two iron sailing vessels, named respectively *Grassendale* and *Aigburth*, and purchased by Messrs. Leyland & Co., a Liverpool firm of shipowners. The gross tonnage register of the vessels is 1,842 and 1,838; total, 3,680 tons. There are on the stocks two duplicate vessels 1,800 tons each; also two small steamers 250 tons each. One of the larger vessels will be launched this month. It may also be stated that one of the vessels in course of construction is of steel.

After many years of slackness, not to say depression, we are pleased to be in a position to congratulate the inhabitants of Chepstow upon a revival of trade, more particularly as regards the operations at the Bridge Works. As most of our readers are aware, some two or three years ago Messrs. Edward Finch & Co. (Limited) in addition to the other branches of business embarked in the iron shipbuilding trade, and though for a time the operations were confined to the building of steam tugs of small dimensions, some benefit accrued to the traders of the place, which as matters stood at that time was exceedingly acceptable. The workmanlike and competent manner in which these small vessels were completed and turned out, it seems has had the effect of inducing other shipowners to entrust orders for ships of larger dimensions and capacity to the hands of the firm, the carrying out of which has benefitted, and it is hoped will still further conduce to the prosperity of the town. The first of these large vessels, built, launched, fitted with engines, boilers, and other appliances, and prepared for sea, was the *Rougemont*, of some 2000 tons, to the order of Messrs. John Cory & Sons, Cardiff, launched in April last, and dispatched in a manner exceedingly creditable to the firm in the early autumn. Shortly after this another large steamer, the *Violante*, some forty feet shorter, built for a Cardiff firm, was successfully launched, the Company has now contracted for £80,000 worth of iron steam shipping, and there is every prospect of a large and increasing business.

Messrs. R. & H. Green, of Blackwall, have launched during 1882 three large steamers, one of them being the *Sphinx*, a fast paddle-wheel armed cruiser for Majeaty's navy. Messrs. Green have also carried out some very heavy repairs to large iron steamers damaged by collision or otherwise. On the whole, 1882 has been for them an extremely busy year, and their graving-docks, more especially the New Granite Dock, which is one of the largest in England (410 ft. by 65 ft.), have been full of work. Messrs. H. Fletcher were so busy during the past year with heavy repairing jobs that they declined all new work. Messrs. Westwood, Baillie, & Co., Isle of Dogs, launched two steam vessels in 1882, of a burthen of 350 and 180 tons respectively. Messrs. Yarrow & Co., the well-known torpedo-boat builders of Poplar, launched thirty-two vessels, eleven of which were for torpedo service, the remainder being principally small steamers for foreign governments. Messrs. W. Walker, & Co., of Millwall, have built during the past year five steamers and one sailing vessel, altogether about 2,600 tons.

LIST OF VESSELS LAUNCHED IN 1882

By Messrs. Edwards & Symes, Cubitt Town.

Class of Ship.	Length.		Breadth.		Depth.		Builders' Tonnage.
	ft.	in.	ft.	in.	ft.	in.	
S.S. Yacht	67	3	11	0	7	0	36
Cargo Steamer	110	0	18	0	10	0	200
Two Steam Launches ...	33	0	6	6	3	0	10
Steam Launch	40	0	8	6	4	0	15
Six Steel Barges	40	0	13	0	3	6	25
Twin Screw, light draught ...	85	0	15	0	7	6	85
,, ,, ,, ...	60	0	12	0	6	0	40
Steam Launch	35	0	7	0	3	9	10
Twin Screw, light draught ...	60	0	12	0	6	0	40
Fire Float	50	0	11	0	6	0	30
Cargo Steamer	110	0	18	0	10	0	200
Twin Screw, light draught ...	60	0	12	0	6	0	40
Composite Launch	40	0	6	9	3	8	12
Steel Launch	33	0	9	0	4	8	15
Cargo Steamer	110	0	18	0	10	0	200
Paddle Steamer	90	0	13	0	6	0	96
Cargo Steamer	135	0	20	6	10	0	275
Paddle Steamer	100	0	18	6	8	9	180

We have already published statistics in connection with shipbuilding on the Clyde, and now add details respecting the shipbuilding on the Mersey. Messrs. Laird Brothers, of Birkenhead, have launched during the year nine vessels, with an aggregate tonnage of about 16,000 tons, and an engine-power of about 2,500 nominal. The list includes the screw steamships *Cephalonia*, of 5,500 tons, for the Cunard Steamship Company; the *Norseman*, of 4,400 tons, for the British and North Atlantic Steam Navigation Company; and Her Majesty's Indian troopship *Clive*, of about 3,300 tons and 400 horse-power; while the Allan Line steamer *Caspian* has been overhauled and fitted with new machinery. Messrs. Laird Brothers have on the stocks, in various stages of progress, three gun vessels and two paddle-wheel tugs for Her Majesty's service; three large screw steamships and a paddle-wheel steamer for river service. Messrs. Thomas Royden & Son have launched during the year three screw steamers—viz., the *Piqua*, of 1,794 tons; the *Elysia*, of 2,790; and the *Burgundia*, of similar tonnage. The same firm have also built during the year five large sailing vessels; so that the total amout of tonnage launched by Messrs. Royden in 1882 was nearly 16,000 tons. They have also done a large amount of business in repairing steamships and sailing vessels. Messrs. W. H. Potter & Son have completed and launched seven iron sailing vessels, with an aggregate tonnage of 14,280 tons; and they have now on hand four vessels of an aggregate tonnage of 8,000 tons. Messrs. R. & J. Evans & Co. have launched during the year a paddle-wheel steamer and two screw steamers, and have three vessels still on the stocks. Messrs. C. & E. Grayson, besides much other work on hand, have undertaken and completed the conversion of the well-known steamship *Great Britain* into a sailing ship, with the classification A 1 at Lloyd's. This vessel was built forty years ago, and in her time carried more passengers and emigrants to Australia than any other vessel afloat. Other firms which execute repairs at Liverpool and Birkenhead have all been well occupied, and it is stated that the prospects for the year are promising.

Messrs. Oswald Mordaunt & Co., Southampton, launched in 1882 seven iron sailing vessels and four iron steamers, together of 24,020.

The trade during the past twelve months has been brisk at Belfast, the two firms of Messrs. Harland & Wolff, and Messrs. Workman, Clark, & Co., have launched 12 vessels, with a tonnage of 27,813 tons, being an increase of 13,920 tons, or slightly over as much more than was turned out in the previous year. Among the steamers turned out by Messrs. Workman, Clark, & Co., may be mentioned the *City of Cambridge*, built for the East India trade. The same firm also built a steel schooner yacht for Mr. George Smith, shipowner, of Glasgow. Messrs. Workman & Co., have at present four steamers on the stocks, two on order, and two finishing at the quay. Mr. Paul Rogers, Carrickfergus, constructed two wooden sailing vessels of an aggregate capacity of 308 tons. The prospects of the trade for the ensuing year are excellent, the present briskness being likely to continue for some time.

LIST OF VESSELS LAUNCHED IN 1882

By the Flensburg Shipbuilding Yard.

Name of Vessel.	Iron or Steel.	Steam or Sail.	German or Foreign Owners.	Gross ton Register.	Nominal Horse power.
Deuteros	Iron	Steam	German	1630.23	160
Nordsöen	,,	,,	Danish	1632.30	160
Tritos	,,	,,	German	1679.47	160
Stern	,,	,,	,,	787.96	80
Glücksburg	,,	,,	,,	1434.76	150
George Dittmann ...	,,	,,	,,	470.74	50
Rogaland	,,	,,	Nor'wgn	1036.69	85
Nerissa	,,	,,	German	881.64	100
H. A. Hartmann ...	,,	,,	Nor'wgn	527.57	70
Mereo	,,	,,	German	1037.10	85
Fero	,,	,,	,,	1037.10	85
				12155.61	1185

The shipbuilding during the last twelve months has been brisk at the Flensburg Shipbuilding Yard at Flensburg. The gross tonnage shows an increase of nearly double since 1880. The above Company build their own engines, all of which have been highly satisfactory. The establishment employ 900 to 950 men. Considering the work that has been done, the figures 12,155 gross tons, and 1185 horsepower, speak well to the steadiness and industry of the workmen.

An Experiment in Marine Engineering.—A new method of creating and maintaining a vacuum in surface condensing engines was, by permission of Mr. Alfred Holt, tried on board the steamship *Cyclops* on Saturday, December 23rd, in the presence of Messrs. Rollo & Blackburn, of Liverpool; Callam, of Leith; Brown, Robertson, and Pollock, of London; and Crompton and Wiles, of Birkenhead. It is the invention of Mr. Robertson, and is patented by him. By it the ordinary air pump is dispensed with entirely, an air extractor being fitted by which the circulating pump is able to maintain the vacuum without in any way interfering with its ordinary work, thus saving the cost of fitting and maintaining an expensive air-pump, and materially reducing the drag and friction of the engines. There was a strong north-westerly gale blowing during the trial, and a heavy sea running, but a steady vacuum of 26½ in. was maintained throughout, and the engines ran more freely than with the air-pump connected, showing an increase of nearly a revolution per minute. The gentlemen present expressed great satisfaction at the results of the trial, and the new system appears likely to be generally introduced. The *Cyclops* proceeded on her voyage to China with the air-pump disconnected, and a further account of the working of the extractor during the voyage will be given on her return.

Mr. N. H. White, the Assistant-Constructor at the Admiralty, and the author of the "Text-book on Naval Architecture," has accepted the position of manager of the limited liability company who are about to take over Sir William Armstrong's works at Elswick. Mr. White will remain at the Admiralty to the end of the financial year under the reorganization scheme which comes into force on the 1st of April. The probability is that no successor will be appointed.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Abington.—On December 23rd there was launched from the shipbuilding yard of Messrs. Wm. Doxford & Sons, Sunderland. She is a screw-steamer 285 ft. long by 37 ft. broad and 23 ft. in depth, and fitted with compound surface condensing engines of 250 nominal horse power. The steamer is owned by Messrs. Renton & Co., Glasgow and Liverpool, and is intended for general trading purposes.

Frederic Morel.—On December 23rd there was launched from the yard of Messrs. John Readhead & Co., South Shields, an iron screw steamer of the following dimensions:—250 ft. by 33 ft. by 23 ft., and having the highest class in Bureau Veritas. The vessel is spar-decked, and will be fitted with engines of 155 nominal horse-power, also made by John Readhead & Co. The vessel has been built to the order of the Compagnie Générale des Bateaux a Vapeur, of Dunkirk, and will be engaged in the French and Mediterranean trades. The steamer was named the *Frederic Morel*, after the managing director, by Madame Morel, of Dunkirk.

Allie.—On December 23rd Messrs. Edwd. Withy & Co. launched from Middleton Shipyard, West Hartlepool, an iron screw steamer built to the order of Messrs. C. Nielsen & Son, of West Hartlepool. The vessel is number 115 in the builders' books. Her principal dimensions are:—Length between perpendiculars, 257 ft. 6 in.; beam extreme, 34 ft. 6 in.; depth, moulded, 20 ft. 4½ in., and her dead weight carrying capacity will be about 2,350 tons. She has topgallant forecastle, long bridge house, quarter deck, and full poop, and double bottom for water ballast under both holds. The decks, bulwarks, rails, and chart-house, as also the skylights and companions, are of iron. She will be fitted with four steam winches, donkey boiler, and patent windlass, by Emerson, Walker & Co., and will be rigged as a double topsail schooner. She has been built under Lloyd's special survey for the 100 A 1 class, and under the personal superintendence of Captain Rodgaard. Engines of 140 nominal horse-power will be fitted by Messrs. Black, Hawthorn & Co., of Gateshead. On leaving the ways the vessel was christened *Allie* by Mrs. Hans Nielsen.

Moorhen.—On December 23rd William Gray & Co. launched from their yard an iron steamer of the following dimensions:—Length, 268 ft.; breadth, 35 ft. 6 in; depth, 19 ft. 9 in.; classed 100 A 1 at Lloyd's. The vessel is built to the order of Messrs. G. T. Pearson & Co., West Hartlepool, and sold by them to the Cork Steamship Company, and fitted with all recent improvements. She has a long raised quarter-deck and long topgallant forecastle extending to foremast, also bridge amidships; over engine-room she has iron main and lower decks laid, and double bottom for water ballast in each hold, four steam winches, and patent windlass by Messrs. Emerson, Walker & Co., of London. The engines, which are 160 horse-power, are being supplied by Messrs. Blair & Co. (Limited), Stockton. On leaving the ways the christening ceremony was performed by Miss Pease, daughter of Arthur Pease, Esq., M.P., Darlington, the vessel being named the *Moorhen.*

Glenmorven.—On December 23rd there was launched to the order of Messrs. Lindsay, Gracie & Co., Newcastle-on-Tyne, from the yard of Messrs. Palmer's Shipbuilding & Iron Co., Limited, Jarrow, an iron screw steamer named the *Glenmorven*, of the following dimensions:—330 ft. extreme length, 40 ft. beam, 26 ft. depth of hold. The *Glenmorven* has been built on the three-decked principle, with double cellular bottom throughout, greatly in excess of Lloyd's requirements, and will be fitted with Palmer's engines, 38 in. and 72 in., with 48 in. stroke, and extra large double-ended steel boilers. She will also receive the crank shaft, built of mild steel, shown by Messrs. Palmers at the Tynemouth Exhibition, and which was awarded the bronze medal; steel propeller blades, steam steering, turning, and starting gear, and every modern improvement.

Suffolk.—On December 23rd, the *Suffolk* (s), of 2,900 tons gross register, was launched from Messrs. Green's dockyard, on the Thames, at Blackwall. This steamer has been built to the order of Messrs. Hooper & Co., of Lombard Street, and is, we believe, the first vessel of her class which has been constructed on the Thames. Her principal dimensions are:—Length between perpendiculars, 300 ft.; breadth moulded, 40 ft.; and depth moulded, 31 ft. She has a bridge-house amidships 72 ft. long, covering the engine-room and stoke-hole, and this house has been arranged for the accommodation of the captain, officers, and engineers, the crew and firemen being berthed in the between decks forward. She is divided into seven watertight compartments, and has a longitudinal bulkhead running fore and aft to prevent grain cargoes from shifting at sea. She will carry about 4,000 tons of dead weight in the hold, or 5,000 tons measurement. The double bottom is capable of holding 400 tons of water ballast. The upper deck and main deck are of iron, the upper deck being planked with 3-in. pitch pine, and a tier of beams in hold. The cargo hatches are worked by four large diagonal steam winches, and the anchors by a powerful revolving crane, and a Davis steam windlass. The engines are by Messrs. Jack & Co., of Liverpool, to indicate 1,600-horse power, which will give the vessel a speed of about 11 knots at sea. The *Suffolk* will class 100 A at Lloyd's. The ceremony of christening and launching was performed by Mrs. Hooper, the wife of Mr. W. Hooper, one of the owners. Among the numerous company present were several members of Lloyd's Committee, with Mr. Martell, the chief surveyor, Captain Murrell, who has throughout superintended the building of the vessel, and many others. Within the last few weeks Messrs. Green have launched a twin screw steel steamer for the Clarence & Richmond River Company, New South Wales, and H.M.S. *Sphinx*; they have on the stocks at the present time a steamer for the Crown Agents for the Colonies, and a composite missionary steamer, named the *Henry Wright*, in memory of the late secretary to the Church Missionary Society. We understand that Messrs. Green have also just received an order from the Admiralty to take in hand the ironclad corvette, *Hecate*, and make considerable alterations and additions to her, in order to adapt her for a much heavier armament than she had hitherto carried.

Millicent.—On December 23rd there was launched from the yard of Messrs. Kish, Boolds, & Co., Pallion, Sunderland, a screw steamer built to the order of Messrs. Fisher, Renwick, & Co., of Newcastle, of the following dimensions:—Length, 195 ft.; breadth, 30 ft.; depth of hold, 14 ft.; with water ballast throughout on the cellular principle. The vessel has been built under the personal superintendence of Mr. A. Taylor, the owner's surveyor, and will be classed 100 A 1 at Lloyd's. She is to be fitted with Nicholas Taylor's steam steering gear, Harfield's patent windlass, Clarke, Chapman, & Gurney's winches, and donkey boiler. The engines are on the double-compound three-cylindered principle, by Messrs. Wigham, Richardson, & Co., of Newcastle. On leaving the ways the vessel was named by Miss Kish the *Millicent.*

East Anglia.—On December 23rd there was launched from the shipbuilding yard of Messrs. Schlesinger, Davis, & Company, at Wallsend, a screw steamer, named the *East Anglia*, which has been constructed to the order of Messrs. Ward & Holzapfel, of Newcastle. This vessel is a sister ship to the *Teutonia* (s), completed by the same builders for the same owners twelve months ago. The *East Anglia's* measurements are:—Length, 290 ft.; breadth, 37 ft.; and depth, 25 ft. 9 in. She classes A 1* in red in the Liverpool Underwriters' Registry, and has been examined during construction by the surveyors of that registry. Powerful steam winches are placed at the hatches; Harfield's patent windlass, patent steam-steering gear, and every necessary will be fitted. Both engines and boilers have been constructed by Messrs. Thomas Clark & Company, of Elswick. Miss Darnell named the vessel in the customary manner.

Birch.—On December 23rd there was launched from the yard of the Strand Slipway Company, Sunderland, a screw steamer for Messrs. Peacock Brothers and partners, of the following dimensions:—Length between perpendiculars, 260 ft.; breadth, 35 ft. 3 in.; depth of hold, 18 ft. 8 in.; to carry 2,300 tons, with engines of 160-horse power by Messrs. J. W. and F. Wilson, of the Monk Street Engine Works; built under the special survey of Lloyd's to both hull and engines for the 100 A class. She was christened the *Birch* by Mrs. Dixon, wife of one of the owners.

Abrota.—On December 23rd there was launched from the yard of Messrs. Short Brothers, at Pallion, Sunderland, a screw steamer, built to the order of Messrs. Graham, Anderson, & Co., Carlisle, of the following dimensions:—Length, 228 ft.; breadth, 32 ft. 6 in; and 16 ft. 3 in. depth of hold; with a deadweight carrying capacity of 1,650 tons. She has been built under special survey to the highest class in the Underwriters' Registry, and is constructed with a long raised quarter-deck, bridgehouse amidships, and topgallant forecastle. All the decks are of iron, with four large hatchways for self-trimming, and powerful steam winch at each, water ballast all fore and aft, and all the latest improvements for quick loading and discharging cargo. She is fitted with steam quartermaster amidships, steel tow lines, Harfield's steam windlass, and the winches and donkey boiler are by Messrs. Clarke, Chapman, & Gurney, of Gateshead. She is to be fitted with engines and boilers of 130-horse power by the North-Eastern Marine Engineering Company, Sunderland, with all the latest improvements in marine engineering. On leaving the ways the vessel was named the *Abrota* by Mrs. Anderson.

Acaster.—On December 23rd Messrs. John Priestman & Co. launched from their shipbuilding-yard at Southwick, Sunderland, an iron screw steamer of the following dimensions:—Length between perpendiculars, 250 ft.; breadth, extreme, 34 ft.; depth of hold, 17 ft.; 1,450 gross tonnage. The vessel has been built to the order of Messrs. Perry, Raimes & Co., of West Hartlepool, under special survey; also under the personal superintendence of Captain Spink, commander, and will be classed 100 A 1 at Lloyd's. Water ballast tanks are fitted in the fore and after holds. also in the after peak, capable of containing in all about 260 tons. The decks are of iron, the quarter-deck being covered with wood. The vessel will be schooner-rigged, having steering gear amidships and screw gear aft; Emerson and Walker's patent windlass on topgallant forecastle; patent donkey boiler, and is fitted with one 6-inch and two 7-inch double cylindered steam winches, by Mr. John Wigham, of South Hylton, and has four cargo hatches. The engines, which will be fitted by Messrs. J. W. and F. Wilson, of Monkwearmouth, are on the compound surface condensing, direct-acting principle, of 130 horse-power nominal; cylinders, 31 and 58 inches, with a stroke of 36 inches. As the vessel glided from the ways she was named the *Acaster* by Mrs. Cundall.

Ybarra No. 4.—On December 23rd there was launched from the yard of Messrs. Raylton, Dixon & Co., Middlesborough, an iron screw steamer, built to the order of Messrs. Ybarra, Hermanos & Co., of Bilbao. She is built on awning deck rule, and of the following dimensions:—Length over all, 280 ft.; breadth, 39 ft.; depth, 18 ft. 9 in.; and will carry about 2,900 tons d.w., will be fitted with large cabin 'tween decks, and in every way a first-class steamer for the Bilbao trade. She has been built under the superintendence of Captain Otero, for her owners, and will have engines of 200 horse-power fitted by Messrs. Blair & Co., Limited, of Stockton. This is the third vessel launched by Messrs. Dixon for the above firm, and is the eighteenth launched this year, which makes up their total tonnage to 27,249 tons. On leaving the ways she was christened *Ybarra* No. 4 by Miss Annie Groves, of Sunderland.

Nivarro.—On December 23rd there was launched at Barrow a schooner-rigged iron screw steamer, named the *Nivarro*, of the following dimensions, viz:—Length between perpendiculars, 350 ft.; breadth moulded, 29 ft. 10 in.; depth in hold, 31 ft. 3 in.; She is built to the spar deck rule, and will class 100 A 1 at Lloyd's. Her owners are Messrs. J. Glynn & Sons, Liverpool.

On December 26th, there was launched from the Howdon yard of Palmer's Shipbuilding and Iron Company, a new screw-steamer, which has been built to the order of Messrs. D'Orbigney, Faustin & Co., La Rochelle, France, of the following dimensions:—Length, 260 ft.; breadth, 37 ft. 6 in; depth, 18 ft. 3 in. She has the Emerson and Walker's patent windlass, and the engines will be supplied by Palmer & Co., and will be of 140 horse-power nominal, the cylinders being respectively 30 inches and 57 inches in diameter, and the stroke of the piston 36 inches.

Winchester.—On December 26th there was launched from the Jarrow yard of Palmer's Shipbuilding and Iron Company this screw steamer, which has been built to the order of Messrs. Blindell, Dale, & Co., Newcastle. The vessel's dimensions are:—Length between perpendiculars, 286 ft.; beam, 37 ft.; depth of hold, 24 ft. 6 in. Her engines will be constructed by Palmer's Company, and the cylinders will be respectively 36 in. and 68 in. diameter, and the piston stroke 45 in.

Ville de Metz.—On December 26th there was launched by Mr. James Laing, at the Deptford Yard, Sunderland, a steamer of 3,200 tons capacity, built to the order of the Havraise Péninsulaire Company, of Havre, and is the fourth steamer built by Mr. Laing for the same owners. Her dimensions are:—Length, 296 ft.; breadth, 38 ft.; depth, 27 ft., hold. She has three decks laid, and will be fitted up for passengers and fine goods. Her engines are of 200-horse power nominal, by Mr. George Clark, Southwick, and she has also Emerson, Walker, & Co.'s patent direct steam windlass, and other special fittings. On leaving the ways she was named the *Ville de Metz* by Miss Swainston, of Sunderland.

Queen.—On December 27th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw steamer, built to the order of Messrs. Taylor & Sanderson, of Sunderland, of the following dimensions:—Length, 280 ft.; breadth, 37 ft.; depth of hold, 20 ft. She is constructed under special survey for the highest class in the Underwriters' Registry, and has a short full poop, long raised quarter-deck, bridge-house amidships, and topgallant forecastle. All the decks are of iron, except the poop deck. She has four large hatchways, with a powerful steam winch at each; water-ballast in main and after holds, steam steering gear amidships, and all the latest improvements. This is the ninth vessel built by Messrs. Short Brothers for the same owners, and we understand that the firm have another vessel to be finished next year. On leaving the ways she was named the *Queen*, the ceremony of christening being performed by Miss Meggie Sanderson, daughter of one of the managing owners. She is to be fitted with engines of 200-horse power, by Messrs. J. W. and F. Wilson.

Iolo Morganrog.—On December 30th there was launched from the yard of the Messrs. Palmer & Co.'s Shipbuilding and Iron Company (Limited), Jarrow, a screw steamer of the following dimensions:—Length, 250 by 33 by 19; deadweight capacity about 2,000 tons on a light draught of water. She has been built under special survey to class 100 A at Lloyd's, and is to be fitted by the same builders with engines of 130-horse power nominal, four steam winches, seven cargo hatchways, shifting-boards to the bottom of the holds to prevent the shifting of grain cargoes, steam steering gear, Emerson & Walker's patent windlass, workable by steam, Chadburn's patent repeating telegraph, and all other modern improvements to secure despatch and economise labour. She was built to the order of Mr. Evan Thomas, of Porthcawl, and Bute-chambers, Cardiff, and is intended for the general trade. The ceremony of christening was performed by Miss Margaret Armstrong, the daughter of Mr. Wm. Armstrong, of Jarrow, who named her the *Iolo Morganrog*.

Dorothy.—On January 8th a new fishing vessel was launched from the shipbuilding yard of Messrs. Walker & Sons, Sandside, Scarborough. The craft, which is named the *Dorothy*, has been built for Mr. H. Champness, of Retford, and W. Baxter, of Filey, has been appointed skipper. The tonnage of the *Dorothy* is from 40 to 50 tons.

Kate.—On January 9th another vessel was launched from the yard of Messrs. Walker & Sons, Sandside. The craft, which is named the *Kate*, of Hull, is intended to sail as a cod vessel. She is fitted with a well for the accommodation of live fish. The dimensions of the vessel are:—Length of the keel, 58 ft.; depth, 10 ft. 4 in.; breadth of beam, 18 ft. 6 in.; and the tonnage, 54. The *Kate* is built for Messrs. Crawford & Co., of Filey, and will be commanded by Mr. Robert Crawford.

Linwood.—On January 9th there was launched by Messrs. C. S. Swan & Hunter, Wallsend, an iron screw steamer named the *Linwood*, built for Messrs. Arthur Holland & Co., London. Her dimensions are:—317 by 38 by 27 moulded depth, class 100 A 1 under special survey at Lloyd's. The vessel has cellular double bottom all the length for water ballast, with iron main deck, partial iron upper deck, and considerable additional strength, and will be fitted with engines (38 and 71 diameter of cylinders of 48 in. stroke) constructed by Messrs. Blair & Co. (Limited), of Stockton, four steam winches by Messrs. Taylor, of Birkenhead, steam steering gear by Messrs. Davis & Company (Limited), London, steel wire hawsers by Messrs. Bullivant & Company, London, &c., and is intended for the Atlantic and East India trades.

Kingston.—On January 9th Messrs. Richardson, Duck & Co. launched from their yard at South Stockton an iron screw steamer of the following dimensions:—Length over all, about 340 ft.; breadth, extreme, 39 ft. 3 in.; depth in hold, 25 ft. to tank top; gross tonnage, about 2,850 tons. This steamer has been built to the order of Messrs. Henry Briggs, Sons & Co., of Hull, who have since sold her to Messrs. Hunting & Pattison, of Newcastle-on-Tyne, and is classed in the highest grade of Lloyd's registry, under special survey; has two complete iron decks, the upper one being covered with wood, a poop aft for the accommodation of captain and passengers, a bridge amidships for officers and engineers, and a topgallant forecastle for the crew. She has a cellular bottom fore and aft capable of holding about 530 tons of water ballast. She is fitted with four steam winches and Baxter's patent windlass, and will be rigged as a three-masted brigantine. The engines, by Messrs. Blair & Co. (Limited), of Stockton, are 230-horse power nominal, cylinders 40 in. and 74 in. by 48 in. stroke. As the vessel was leaving the ways she was christened the *Kingston* (pro. tem.) by Mrs. Todd, of Saxmundham.

Olivia.—On January 11th a vessel was launched from Messrs.

Mordey & Carney's shipbuilding yard, Newport (Mon.). The vessel was named the *Olivia* by Mrs. Watson, of Goldtops, wife of the second partner in the firm of Pyman, Watson & Co. The *Olivia* is 120 ft. long, 22 ft. beam, and 10 ft. in depth, and was built to the order of Mr. John Fry, of Cardiff, and subsequently sold to Mr. Hunter, of Glasgow.

Maroon.—On January 11th Messrs. Edward Finch & Company (Limited) launched from their shipyard at Chepstow, an iron screw steamer, built to the order of Messrs. C. O. Young & Christies, of Cardiff. The vessel is No. 34 in the builders' yard. Her principal dimensions are: —Length, 240 ft. 'tween perpendiculars; beam extreme, 35 ft. 2 in.; and depth of hold, 18 ft. 3 in. She has been built under Lloyd's special survey for the highest class, 100 A 1; has long raised quarter deck; iron poop house aft for passenger saloon, and cabins; long bridge, and topgallant forecastle. She has double bottom for water ballast in both holds, and in the boiler room are four powerful steam winches, patent windlass, by Baxter, worked from steam winch, iron decks, and is constructed throughout in a specially superior manner, and will be rigged as a topsail schooner. She will receive engines of 130 nominal horse-power, to be fitted by the builders. The steamer, upon leaving the ways, was christened *Maroon* by Miss Rowe, daughter of the managing director for the builders.

Saxmundham.—On January 11th the North of England Shipbuilding Company (Limited) launched from their yard at Pallion, Sunderland, an iron screw steamer of the following dimensions and particulars:—Length, 315 ft.; beam, 39 ft.; depth of hold, 25 ft. 6 in. On leaving the ways the vessel was named the *Saxmundham*, by Mrs. Todd, of Brandfield-hall, Saxmundham, wife of one of the shareholders of the vessel. The steamer has been built to the order of Messrs. Hunting & Pattison, of Newcastle, under the superintendence of Captain Brunton, of Tynemouth, and has been built to be registered in the highest class at Lloyd's, 100 A 1, under the three-decked rule. She will be rigged as a two-masted schooner, and will have five steam winches and an extra large donkey boiler, by Messrs. Clarke, Chapman, & Gurney, Gateshead; a direct-acting steam windlass by Messrs. Harfield & Company, London, the steam steering gear, which is on the combined hand and steam principle, has been manufactured by Messrs. Donkin & Nichol, of Newcastle. The vessel has been carefully designed for the American, Indian, and Mediterranean trades, and all the arrangements of the vessel have been planned for the rapid loading and discharging of cargo. The vessel will be capable of carrying over 3,700 tons, and has full poop aft for the accommodation of captain and officers, bridge amidships, extending the whole length of engine and boiler space, where accommodation has been provided for engineers, whilst the seamen and firemen will be berthed in the topgallant forecastle. The vessel has a main deck of iron, and the upper deck is composed of iron for three-quarters the vessel's length, sheathed with yellow pine, and in addition to Lloyd's requirements, the vessel has a doubling strake on each side, which adds considerably to her strength. The vessel will be engined by the North-Eastern Marine Engineering Company (Limited), of Sunderland and the Tyne. The engines, which will be on the compound surface-condensing principle, are 250 horse-power nominal, and will combine all the most recent improvements in marine architecture for economic working. The engines have been erected under the superintendence of Mr. White, of Newcastle.

Retford.—On January 20th Earle's Company launched from their yard at Hull an iron twin-screw steamer for the Manchester, Sheffield, and Lincolnshire Railway Company's Grimsby and Rotterdam service. The vessel was named the *Retford* by Miss Norfolk, of Grimsby. This boat has been constructed to class 100 A 1 in the Lloyd's registry, and her dimensions are as follows:—Length between perpendiculars, 230 ft.; breadth moulded, 32 ft.; depth of hold, 13 ft. She has a topgallant forecastle, bridge, and long poop extending to the bridge, and there is accommodation under the poop for 30 first-class passengers, the second-class passengers accommodation being forward, and the emigrants' quarters in the fore 'tween decks. She is schooner-rigged with pole masts, and is fitted up with water ballast. She will be propelled by compound twin-screw engines, each having two cylinders 23 in. and 43 in. diameter by 27 in. stroke. Steam will be supplied at 85 lbs pressure by two large boilers. The collective nominal horse-power will be 150 horse.

Primate.—On January 23rd there was launched from the yard of her builders, Messrs. Raylton, Dixon, & Co., a handsome screw steamer of the following dimensions:—Length over all, 270 ft.; breadth, 35 ft. 9 in.; depth of hold, 19 ft. 10 in.; with a deadweight capacity of about 2,550 tons. She is built to class 100 A 1 at Lloyd's, has main and quarter-deck of iron, short poop, topgallant forecastle, and long bridge amidships, with accommodation for officers and engineers, steam winches, Harfield's windlass, and all the latest improvements, engines of 150 horse-power will be fitted by Messrs. Thos. Richardson & Sons, of Hartlepool, and her rig is that of a brigantine. She has been built to the order of Messrs. Edward Harris & Co., of Middlesbro', and is the seventh vessel built by Messrs. Dixon for this firm. On leaving the ways she was christened *Primate* by Mrs. Fred Williams, of Norton.

LAUNCHES.—SCOTCH.

Breslau.—On December 22nd, Messrs. Robert Steele & Co., of Greenock, launched a steel screw steamer which they have built to the order of Messrs. James Currie & Co., of Leith, to be employed by them in the passenger trade between Leith and Hamburg. Her dimensions are:—Length between perpendiculars, 254 ft. breadth, 33 ft.; depth moulded, 17 ft. 9 in. She is fitted up forward with accommodation for 56 first-class passengers. The officers are accommodated under the bridge amidship. In the poop and 'tween decks aft accommodation is provided for 170 second-class and steerage passengers. She will be rigged as a three-masted schooner, with pole masts of steel. Four powerful winches are fitted on the upper deck for the rapid loading and discharging of cargo. There is also a patent windlass, steam steering gear, and all the latest improvements in passenger steamers. She will be fitted by the builders with a pair of compound surface-condensing engines, having cylinders 38 and 60 in. clear respectively, with a stroke of piston of 42 in. The ceremony of launching and naming the *Breslau* was performed by Mrs. Wm. Grier. Immediately after the launch the steamer was towed alongside the crane in the Victoria Harbour, where her boilers and machinery will be put on board. Messrs Steele & Co. have a sister steamer on the stocks to be named the *Coblens*, and which they expect to launch shortly.

Mongkut.—On December 23rd there was launched from the shipbuilding-yard of Messrs. John Elder & Co., at Fairfield, Govan, a steel screw steamer called the *Mongkut*, for the Scottish Oriental Steamship Company (Limited), of the following dimensions:—Length, 260 ft.; breadth, 35 ft.; depth moulded, 24 ft.; gross tonnage, about 1,500. The engines are of the usual compound inverted cylinder type, the high-pressure cylinder is 30 in. diameter, and the low-pressure 60 in.; stroke 3 ft. The steam is supplied from two single-ended steel boilers, with three furnaces in each, at a pressure of 110 lbs. The vessel is classed in the highest grade of the Bureau Veritas, and is fitted up for a few European and Chinese passengers, but is principally intended for the cargo trade. She is the first of three vessels now building by Messrs. John Elder & Co. for the same company. As the vessel left the ways she was named by Mrs. Briggs, of Edinburgh.

Oregon.—On December 23rd Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun, the *Oregon*, an iron screw steamer which they have built to the order of Messrs. Flinn, Main & Montgomery, Liverpool, for the Mississippi and Dominion Steamship Company (Limited). The *Oregon* is a sister ship to the *Sarnia*, launched by them for the same company in the summer of this year, and, like her, is built with a number of extras beyond requirements for their highest class, and has accommodation for a large number of first-class, intermediate, and steerage passengers. As she left the ways she was named by Miss Connell, Rozelle, and was immediately taken to Finnieston Crane, where the machinery will be fitted on board by Messrs. John & James Thomson, Finnieston Engine Works. She has Emerson, Walker's patent horizontal direct-acting windlass, driving warping capstan on forecastle deck.

Richmond Hill.—On December 23rd the large twin-screw vessel *Richmond Hill* was launched from the shipyard of Messrs. Henry Murray & Co., Dumbarton. The *Richmond Hill* is one of four vessels comprising the fleet of the Twin-Screw Steamship Line, of Liverpool, all of which have been built upon the Clyde within the the last eighteen months. She is 420 ft. long between perpendiculars, 47 ft. beam, and 26 ft. 6 in. depth of hold, and measures about 4,300 tons gross. The material employed in her construction throughout is Siemens-Martin steel, supplied by the Steel Company of Scotland. She has two entire steel decks, and her forward and after extremities are covered in by steel shelter decks shaped dome-fashion. She has seven watertight transverse bulkheads all extending to upper deck. She has been built in accordance with Lloyd's rules for the 100 A 1 class, and holds Lloyd's special survey certificates, while the Admiralty place her on the list of merchant vessels whose construction and appointment render them eligible for transport service. State-room and saloon accommodation for 50 first-class passengers is provided in a citadel extending over 200 ft. amidships. Her machinery will be supplied by Messrs. James Howden & Co., Glasgow, who have also been the engineers for the three preceding vessels—the *Notting Hill*, *Tower Hill*, and *Ludgate Hill*. The engines will be of the compound inverted direct-acting type, having four cylinders each. These are expected to develop 3,300-horse-power indicated, the steam being supplied from three steel multitubular boilers. She is fitted with a powerful direct-acting windlass, by Messrs. Emerson, Walker, & Co., 11, Leadenhall Street, London. The most noteworthy feature of the *Richmond Hill*, as well as of the three preceding vessels, is, of course, the fitting them with twin-screws through which their great power is exerted, instead of, as almost universally prevails in the merchant service, through the single propeller. The advantages of this system have often been advocated for large ocean-going steamers, and its adoption in the present line of steamships will probably lead the way to its being more largely followed.

Sylvan.—On December 23rd there was launched from the building yard of Messrs. Murdoch & Murray, Port Glasgow, a screw steamer, 120 ft. by 20 ft. by 9, classed at Lloyd's under special survey, with iron decks. The vessel has been built to the order of Messrs. Wilson, Hart & Co., Maryborough, Queensland, and is to be employed in the Colonial coasting trade. As the vessel left the ways she was named the *Sylvan*, by Miss Jessie Hart, of Maryborough, Queensland, daughter of one of the owners. The machinery will be supplied by Messrs. Duncan, Stewart & Co., London Road Iron Works, Glasgow.

St. Helier.—There was launched on December 23rd from the shipbuilding-yard of Messrs. Burrell & Son, Dumbarton, this screw-steamer, of about 1,700 tons burden, built to the order of Messrs. Hacquoil Brothers, of Cardiff, and intended to be employed in their Spanish trade. She will be engined by Messrs. Matthew Paul & Co., Dumbarton.

Kampokus.—On December 23rd Messrs. David and William Henderson & Co. launched from their Meadowside Works, Partick, this iron screw-steamer, of the following dimensions:—Length, 160 ft.; breadth, 25 ft.; depth, 14 ft.; and 500 tons gross. The vessel has been built to the order of Messrs. Alexander Slorach & Son, Cork, for their coasting trade, and will be fitted by her builders with machinery of the most modern type.

Loch Ard.—On December 23rd Messrs. Ramage & Ferguson launched from their shipbuilding yard at Leith a steel screw-steamer of about 1,400 tons gross register, and 1,900 tons dead weight capacity, built to the order of Messrs. Ireland, Leitch & Co., Dundee, for the Dundee Loch Line Steam Shipping Company. Her dimensions are, 256 ft. k. and f., by 32 ft. beam, by 21 ft. 6 in. deep, moulded, and she will be propelled by engines having cylinders 27-inch and 54-inch diameter, by 48-inch stroke, working at 90 lbs. pressure, also made by Messrs. Ramage & Ferguson, at Leith; and Emerson, Walker & Co.'s patent capstan windlass. As the steamer left the ways she was named the *Loch Ard* by Miss Annie Connel, daughter of Mr. J. Connel, of the Lochgelly Iron and Coal Company, Burntisland.

Waroonga.—Messrs. A. & J. Inglis, Pointhouse, launched on December 25th this steel screw-steamer, 2,500 tons gross, for the British India Association. This vessel is a sister ship to the *Bulimba*.

Karamania.—On December 26th Messrs. David and William Henderson & Co. launched from their shipbuilding yard at Meadowside, this iron screw-steamer, built to the order of the Barrow Steamship Company, and having the following dimensions:—Length, 340 ft.; breadth, 39 ft.; depth, 29½ ft., with a gross tonnage of 3,250. She will be supplied by her builders with engines of 480 horse-power, and she has also a horizontal steam windlass (Emerson and Walker's patent), with warping capstan on upper deck.

Balkan.—On December 26th Messrs. M'Millan & Son launched from the Dockyard, Dumbarton, this steamship, 1,800 tons and 1,500 horse power, built to the order of Messrs. Fraissinet & Co., Marseilles. The vessel is to be engaged in the Mediterranean and Black Sea trades. The *Balkan* is a sister ship to the *Taurus*, launched by the same firm in October of last year. She is fitted with Messrs. Emerson Walker's patent direct-acting windlass with warping capstan on same deck, and is the seventh steamer and fourth similar steamer built by Messrs. M'Millan for the above firm, and will be engined by Messrs. Denny & Co.. Dumbarton.

Aurania.—On December 26th a new vessel for the Cunard Company named the *Aurania*, was launched from the shipbuilding yard of Messrs. James and George Thomson, Clydebank, Glasgow. The new Cunarder is a vessel of 7,500 tons gross register, and is built throughout of steel, but she is not classed in any registry, though her scantlings are considerably above the requirements of Lloyd's. Messrs. Thomson proposed to the Cunard Company that instead of building a vessel of the proportions of the *Servia* they should build one of only eight beams in the length, and consequently much shorter. The directors of the Cunard Company, after due consideration, decided to build a vessel of the following dimensions:—Length over all, 485 ft.; breadth, extreme, 57 ft.; depth, moulded, 39 ft. 9 in. The immense beam of the *Aurania* naturally gives her very great stability, so that even with nothing in her holds she is quite capable of being easily handled. The internal arrangements of the ship have been subordinated to considerations of strength and safety, for she has no less than 11 water-tight bulkheads, all of which are carried up to the upper deck. She will therefore not only fulfil the Admiralty condition of being able to float with one compartment filled, but she would be quite safe with any two completely flooded. The *Aurania* has an enormous spread of sail, and she looks more like a large sailing ship than a steamer. She could, therefore, make a very rapid passage under sail alone. She could, however, carry coal sufficient to enable her to go round the world at 15 knots an hour without calling at any port to replenish. She has accommodation on two decks for 500 first-class passengers in 158 state rooms. The facilities for rapid discharge and shipment of cargo have received great attention. The *Aurania* has a forecastle 97 ft. long, fitted up for the accommodation of a part of the crew, and also for the housing of the necessary wash places, &c., for emigrants. She has a poop 74 ft. long, containing similar accommodation to the forecastle, and in addition some rooms for the officers, and a large room, 32 ft. by 20 ft., in which the steering gear of the ship is placed. She will have 12 boats, all carried well above the promenade deck, so that they will be practically free from chance of damage. All the houses on deck are strongly built of iron, and the openings to the engine and boiler rooms are protected by double casings, one being placed about six feet inside the other. The ship will be lighted throughout with the Swan electric light, having about 600 lights in all. The engines of this ship, which are capable of developing about 10,000-horse power, have three cylinders, one of 68 in. and two of 91 in. each, with a stroke of 6 ft. There are eight boilers. 15 ft. in diameter, working at 90 lb. pressure, all made of steel, and fitted with 42 of Fox's patent corrugated furnaces. The ceremony of naming the vessel the *Aurania* was performed by the Countess of Eglinton.

Glenogle.—On December 26th there was launched from the shipbuilding-yard of Messrs. A. Stepher & Sons, of Dundee, a steel barque named the *Glenogle*. Her dimensions are as follows:—Length, 204 ft.; breadth, 34 ft.; depth 19 ft. She has been built to the order of the Dundee Shipowners' Company (Limited), and is a sister ship to the *Glenfyne*, launched two or three weeks ago for the same owners, and like the first launched, she has an Emerson & Walkers patent lever windlass. The *Glenogle* is to be commanded by Captain Marshall, and is to load iron at Grimsby for the River Plate.

Cumbrae.—On December 26th Messrs. Dobie & Co. launched from the Govan Shipbuilding-yard, Glasgow, an iron screw steamer of about 950 tons gross, classed 100 A 1 at Lloyd's, and built to the order of the Clyde Shipping Company, Glasgow, for their coasting trade. The machinery is being supplied by Messrs. Lees, Anderson, & Co., Clyde Street, Anderston. As the vessel left the ways she was named *Cumbrae* by Mrs. Cuthbert, wife of one of the owners.

Phra Chom Klao.—On December 27th Messrs. Caird & Co., Greenock, launched from their yard a screw steamer built on the cellular system for Mr. W. Sinclair, of Bangkok, Siam. She is 265 ft. in length, 23 ft. in depth, and 35 ft. in breadth. She is 1,500 tons gross, and is constructed as a cargo-carrying steamer. Her engines, which are to be supplied by the builders, will be of 1,200 horse-power. As she left the ways she was named the *Phra Chom Klao* by Miss Caird. The new steamer, which has been built to the highest class at Lloyd's, and is to be supplied with every modern appliance for the rapid loading and discharging of cargo, is to trade in Siam waters.

Orowaiti.—On December 28th Messrs. H. M'Intyre & Co. launched from their shipbuilding-yard at Merksworth Paisley, the *Orowaiti*, an iron screw steamer of 700 tons, built to the order of the Westport Company of New Zealand, under the superintendence of John Darling, Esq. The *Orowaiti* is classed 100 A 1 at Lloyd's, and fitted with all the latest improvements as a cargo steamer. She is a sister ship of the *Kawatiro*, launched in August for the same firm. Both steamers were engined by Messrs. Fleming & Ferguson, Paisley. The *Orowaiti* was named by Mrs. Colquhoun, Dalmeny House, Ibrox.

Nerbudda.—On December 28th Messrs. William Denny & Brothers launched from Leven Shipyard, Dumbarton, the *Nerbudda*, a steel screw steamship of about 3,000 tons gross register, for the British India Steam Navigation Company (Limited). The *Nerbudda* is 320 ft. long between perpendiculars; 42 ft. breadth, moulded; and 28 ft. 6 in. depth, moulded. She is constructed of steel, supplied by the Steel Company, of Scotland, her scantlings being in accordance with, and in many respects in excess of, Lloyd's requirements for the 100 A 1 three-decked class of vessels. Her bottom throughout is constructed on the structural cellular principle, and is adapted for carrying about 650 tons of water ballast. The upper deck is plated throughout its entire length with steel, and the vessel has eight transverse steel bulkheads, six of which are watertight, and extend, with one exception, to the height of upper deck. The *Nerbudda* is fitted for 32 first-class passengers and 15 second-class, the former being located in the poop and the latter in midship side houses. Accommodation for the officers and engineers is provided in midship houses, and the forecastle is occupied by the crew. The *Nerbudda* is fitted with every facility for the rapid discharge and shipment of cargo, including no fewer than eight horizontal steam winches of Messrs. Clark, Chapman, & Gurney's make, fitted double at all the hatchways. A steam steering engine of Muir and Caldwell's patent is fitted amidships, and at the rudder-head a right and left screw-steering gear, of Napier's make, is fitted. A powerful steam windlass, of Paul & Co.'s patent make, is fitted on the forecastle-head for working the anchors. The machinery of the *Nerbudda* will be fitted by Messrs. Denny & Co. This will comprise engines of the inverted direct-acting compound type of 2,000 indicated horse power, having cylinders 41 in. and 72 in. diameter, and 4 ft. 3 in. stroke of piston. Steam of 70 lbs. pressure will be supplied from two cylindrical boilers, 13 ft. 3 in. diameter, having six furnaces each. The *Nerbudda*, it may be stated, is the forty-sixth vessel built by Messrs. Denny & Brothers for the British India Company. The ceremony of naming the *Nerbudda* was performed by Miss M'Naughton, daughter of P. M'Naughton, Esq., Secretary of the British India Company.

There was launched on December 29, from the shipbuilding yard of Messrs. T. B. Seath & Co., an iron screw-steamer of 160 tons burthen, being 115 ft. long, 19 ft. broad, and 9 ft. 6 in. deep. The engines are compound surface-condensing, of 300 indicated horse power, which will give a speed of 11 knots an hour. The vessel is intended principally for towing and cargo purposes in South Australia.

Goldenhorn.—On January 8th Messrs. Russell & Co. launched from their shipbuilding-yard, at Greenock, a four-masted iron sailing vessel, which they have built to the order of Mr. James R. de Wolf, of Liverpool, specially for the Calcutta and San Francisco trades. Her dimensions are :—Length, 266 ft.; breadth, 40 ft. 2 in.; depth, 23 ft. 9 in.; and she will register about 1,840 tons. This vessel, which was christened the *Goldenhorn* as she left the ways, is a sister ship and in every respect similar to the *Matterhorn*, built last year by Messrs. Russell & Co. for the same owner. Both these vessels have been constructed with every care, considerably above Lloyd's requirements (including three rows of stanchions to the beams), and are fitted with every modern improvement, including a double purchase capstan windlass (Emerson & Walker's patent), and classed 100 A 1 at Lloyd's. We are informed the *Goldenhorn*, after completing her outfit, will load at Liverpool for Calcutta.

Ardgowan.—On January 11th there was launched from the Abercorn Shipbuilding Yard, Paisley, an iron screw steamer of about 300 tons. She is built for the Ardgowan Steam Navigation Company (Limited), Messrs. Craig, Scott, & Co., managers, Greenock. As the vessel left the ways she was named the *Ardgowan* by Miss Lyle, daughter of one of the owners. Her engines are 18 in. and 34 in. by 28 in. stroke, 200-horse power, and will be supplied by Messrs. W. G. Lochhead & Co., Glasgow.

Arethusa.—On December 23rd Messrs. R. Napier & Sons launched from their shipbuilding yard at Govan, the second of the three fast steam cruisers they are building for Her Majesty's Navy. These ships are intended to act as armed despatch vessels, and also to protect our commerce in time of war. As it is essential that an unarmoured cruising man-of-war should be able to overtake any vessel desirable to capture, and to evade any powerful fighting-ship they have been designed to attain a high rate of speed with a large coal capacity. The principal dimensions of the three are :—Length between perpendiculars, 300 ft.; breadth, extreme, 46 ft.; draft, 20 ft.; with a displacement of 3,750 tons. Each ship will be fitted with two pairs of horizontal compound engines driving twin screws, and eight circular steel boilers capable of developing 5000 horse-power for a speed of 16 knots. The hulls are wholly constructed of steel which has been manufactured by Messrs. I. and W. Beardmore, who have also supplied the steel for the boilers. Although not armour-plated, the vessels have been so designed that the bunker coals afford very efficient protection to the sides of the ship. The bottom is constructed upon the longitudinal bracket-frame system, with an inner skin, and has been sub-divided into numerous watertight compartments to guard against damage from torpedoes. The engines and boilers are kept below the water-line, and protected from plunging fire by a steel deck, formed of 1½ in. plates, while the bunkers, with eight feet of coal a-side, act as very efficient protection from shot or shell. In fact, the vital parts of the ship, comprising the engines, boilers, and magazines, are enclosed in a space which is protected all round, and forms, so to say, a ship within a ship, of which the outer part might be damaged and yet the vital parts remain intact. The armament is to be of a powerful and novel description. It will consist of ten 6-inch breechloading guns, two Gatling guns, six Nordenfelt guns, and ten Whitehead torpedoes. Four of the breechloaders are mounted upon Albini carriages, and fixed on revolving turntables which project beyond the sides of the ship. The remaining six-pounders are fitted at broadside ports, and the Nordenfielt guns are placed into projections on the topsides being so arranged as to give great training and depression for firing into boats close alongside. Each gun is capable of firing 250 rounds per minute. Besides the usual number of boats for a war vessel of this class, two torpedo boats will also be carried, and the ship will be barque rigged, with a large spread of canvas.

Viking.—On January 9th a steamer, named the *Viking*, built to the order of the Western and Brazilian Telegraph Company, was launched from Craigie shipyard, Dundee, Messrs. Pearce Brothers. The vessel is 145 ft. long, 23 ft. in breadth, with a depth of hold of 12 ft. to the main deck, and of 19½ ft. to the spar deck; she is 460 tons gross, and has been built above the requirements of the highest class at Lloyd's. Having been specially built as a telegraph steamer, to be employed on the coast of South America, the *Viking* has been fitted with the necessary machinery for picking up, repairing, and laying telegraph cables, and has accommodation for a large staff of telegraph engineers, besides the officers and crew of the vessel. Engines of 65 horse-power are to be fitted on board the steamer. Captain Wardroper has been appointed to the command of the *Viking*.

Hawarden Castle.—There was launched on January 11th from the shipbuilding-yard of Messrs. John Elder & Co., Glasgow, a large steamer, built to the order of Messrs. Donald Currie & Co. for the Castle Mail Packet Company's South African service. Unusual interest attached to the ceremony from the fact that the vessel was christened the *Hawarden Castle* by Mrs. Gladstone, who made a special visit to Glasgow in order to discharge this duty. In a few weeks Messrs. Elder will launch a sister ship to the *Hawarden Castle*, to be named the *Norham Castle*. The dimensions of the new vessels are as follows :—Length on water line, 380 ft.; length over all, 393 ft. 6 in.; breadth, 48 ft.; depth, 30 ft.; with a gross tonnage of about 4,300 tons. Each vessel is divided into nine principal watertight compartments; several of the compartments are also sub-divided by partial watertight bulkheads, extending to the hold beams, formerly ballast tanks. Provision has been made for several hundred tons of water ballast, in order to secure regularity of trim. The grand saloon, placed in the midship portion of the ship, just abaft the engine-room, is about 44 ft. square, and is finished in a classic style, specially designed. The principal woods used in the decorations are walnut and oak. All the entrances and corridors, saloon, smoking saloon, ladies' boudoir, captain's cabin, chart room, engine room, &c., are fitted with electric lights on the incandescent principle. Over the after-decks, and extending right to the taffrail and over the full breadth of the vessel, is fitted a hurricane deck, forming an extensive promenade for the sole use of the first-class passengers. The second-class saloon and state rooms are arranged forward of the machinery space. Accommodation is provided for about 190 first-class and 160 second-class passengers. These vessels carry the large number of ten boats, eight of which are lifeboats of very large dimensions. Steam steering-gear of the best and strongest type is fitted on the bridge-deck, together with hand-gear, which can be used should the steam-gear become disabled. As an additional safeguard, powerful screw-steering apparatus, with double wheels, is fitted aft. The engines are compound, inverted, direct acting, of the most improved type, indicating nearly 4,000 horse-power. In addition to the *Hawarden Castle*, and the *Norham Castle*, the Castle Packet Company are building steamers of the aggregate tonnage of about 14,000 tons and 11,000 horse-power, all of which will be ready for sea early in the spring.

George Lambe.—On January 12th there was launched from the yard of Messrs. Pearce, Brothers, Dundee, an iron screw steamer, 152 ft. long by 23 ft. beam; and 12 ft. 2 in. depth of hold; 400 tons gross register. The vessel has been built under special survey, and is in the highest class at Lloyd's. The engines are 70 horse power nominal. She is owned by Mr. W. P. Annear, of Cardiff, and will be employed in the China trade. As the vessel left the ways she was christened *George Lambe*, by Mrs. Mitchell.

LAUNCHES.—IRISH.

Louie Bell.—On November 28th a new vessel was launched from the shipbuilding yard of Mr. Paul Rodgers. Her dimensions are as follow:—Length, 95 ft.; breadth, 22½ ft.; depth, 9¾ ft. Her register tonnage will be about 100 tons, and her carrying capacity is estimated at 210 tons. The christening ceremony was gracefully performed by Miss Johnston, Knockagh House, who named the new craft the *Louie Bell* as it moved down the ways into the water. The *Louie Bell* will be classed 12 years A 1 at Lloyd's. She has been built to the order of Messrs. James Fisher & Sons, of Barrow-n-Furness, and is being fitted out under the supervision of Captain Henry W. Atkinson, superintendent for that firm. It is expected that she will be ready for sea in a few days. A large number of people witnessed the launch of the new ship, which was very much admired; and Mr. Rodgers, her designer and builder, received the hearty congratulations of numerous friends. It is gratifying to find this branch of local industry in such a flourishing condition. Two more new vessels are at present in hand, and a number of coasting vessels are undergoing repair.

Ionic.—On January 10th the steamer *Ionic*, the first of two additions to the White Star fleet, was launched from the yard of Messrs. Harland & Wolft, in Belfast. The ship is intended to be illuminated throughout by a system of electric lighting. She is divided into eight water-tight compartments. The *Ionic* is built of mild steel, the ductile quality of which insures the maximum of strength and durability. Her dimensions are:—Length, 440 ft.; breadth, 44 ft.; depth, 32 ft·; and the gross register tonnage, 5,000 tons. She has two double-cylindered engines of 500-horse power, also built by Messrs. Harland & Wolff, the steam for which is supplied from three elliptical boilers, working at an initial pressure of 90 lbs. to the square inch, but tested by the Board of Trade to double that pressure, and capable of bearing even much greater pressure than the maximum official requirement. The crank shafts are of steel, and so constructed that the risk of a breakdown is rendered a remote contingency, the more so as the engines are two distinct and complete machines, capable of being disconnected and worked separately at a reduced speed. The *Doric*, a sister ship to the *Ionic* in all respects, will be launched in February.

LAUNCHES AND TRIAL TRIPS—SWEDISH.

Adam.—On January 10 this iron screw-steamer was launched from the yard of Ljusne Mekaniska Verkstad, Sweden. Her dimensions are:—Length between perpendiculars, 132 ft.; breadth, 24 ft.; and she draws, when loaded, 11 ft. of water. She is intended for trading, loading a cargo of 300 tons dead weight, and built for account of Mr. Kempe, Söderhamn.

Korsör.—This vessel was recently launched from the yard of the Kockum Mekaniska Verkstad, Malmö. She is the first of four steam-ferries ordered by the Danish Government for the transport of railway trains intact, across the Store Belt. She is 260 ft. long, and 35 ft. wide, and capable of receiving a train of 16 carriages with engine on rails laid on the deck. For the accommodation of passengers, she is fitted with saloons and every comfort below deck. The vessel is built entirely of Swedish Bessemer steel, and will receive paddle-engines of 1,600 indicated horse-power, which are expected to give her a speed of 13 knots. She is shaped alike both fore and aft, with a rudder in each end.

Ystad.—On December 23rd this iron screw-steamer, recently launched from the yard of the Oskarshamn Mekaniska Verkstad, Oskarshamn, Sweden, went on her trial trip. Her dimensions ate:—Length between perpendiculars, 125 ft.; breadth, 22½ ft., and she draws, with a cargo of 300 tons dead weight, 10½ ft. The trial was in every respect a successful one, her engines of 40 nominal horse-power giving her a speed of 8·33 knots per hour, with a coal consumption of 5 cubic feet per hour. The contract was for 7 knots per hour, with a coal consumption of 8½ cubic feet. The vessel belongs to a syndicate at Oskarshamn.

TRIAL TRIPS.

Devonia.—On December 5th the *Devonia* (s), recently launched from the shipbuilding-yard of Messrs. Murdoch & Murray, Port Glasgow, went down the Clyde on her trial trip. This vessel has been built to the order of Messrs. Dunsmuir & Jackson, Govan, for the London and South-West Coast Steamship Company, Limited, and is the first of a new line of steamers intended to open up the coasting trade of the south-west coast of England. She is built entirely of steel, and has great power, her engines working at a pressure of 100 lbs. per square in. After adjusting compasses at the Gareloch, the measured mile was run, when a speed of 12½ knots per hour was attained. Captain Croft and Messrs. Renwick & Ferguson, who represented the company, expressed themselves entirely satisfied with the performance of the vessel.

City of Cambridge.—On December 22nd the steamship *City of Cambridge*, 3,700 tons gross register, built by Messrs. Workman, Clark, & Co. (Limited), Belfast, to the order of Messrs. George Smith & Sons, Glasgow, proceeded down the Clyde to the Gareloch, and, after adjusting compasses, was joined by a party of the owners and their friends. Thereafter the ship went down for a run to Cumbrae, and on the homeward run was tried on the measured mile at Skolplorlie, and accomplished the average speed of 13½ knots.

Angers.—On December 23rd the new steamship *Angers* (the completion of which was delayed by the weather for some weeks) went her trial trip from Hull. After adjusting her compasses off Grimsby, she ran several trials over fixed distances, giving a mean speed of 11½ knots per hour, the engines working with great ease at 60 revolutions per minute, and developing 1,250 horse-power indicated—a very satisfactory result. Her dimensions are:—Length, 320 ft.; breadth, 40 ft.; depth of hold, 28 ft. 3 in.; capacity, 4,200 tons deadweight; 5,200 tons measurement, with 7 ft. 4 in. clear side to the spar deck. She has a topgallant forecastle bridge 80 ft. long, and house aft, all built of iron, accommodation for officers, engineers, and crew, and for 12 to 16 first class passengers. She is schooner-rigged, and well arranged for loading and discharging cargo with despatch. The engines are by C. D. Holmes & Co., of Hull, of 300 horse-power nominal. The boilers are extra large, of Siemens steel, including a large horizontal tubular donkey boiler connected to the main steam pipe, and capable of moving the ship in dock, &c., or augmenting the main boiler power at sea, and providing ample steam for the five large winches. The ship was built under the superintendence of Captain Cassap and Mr. M'George, superintendents to the owners, Messrs. Angier Bros., of London. After the trial she steamed for Philadelphia.

Carbis Bay.—On December 23rd the steamship *Carbis Bay* had a satisfactory trial trip off the coast of Northumberland. The weather was fine, and throughout the trial, which lasted several hours, both ship and engines gave every satisfaction. Although the vessel was very light, having only her water ballast on board, a mean speed of 10½ knots was obtained. The *Carbis Bay* is an iron screw steamer, classed 100 A 1 at Lloyd's, and fitted with every modern appliance to secure despatch in loading and unloading cargoes and for the working of the vessel. Her dimensions are:—Length between perpendiculars, 265 ft.; breadth moulded, 36 ft.; and depth of hold, 19 ft. The steamer was built by Messrs. Schlesinger, Davis & Co., of Wallsend, for the Carbis Bay Steamship Company (Limited), the managing owners being Messrs. F. Banfield & Sons, of Penzance, for whom Messrs. Schlesinger, Davis & Co. have now built three steamers. The engines are inverted direct acting compound surface condensing, having cylinder 32 and 62 in. diameter, with a stroke of 42 in. to each. These have been made and fitted by Messrs. R. & W. Hawthorne, of St. Peters.

Parramatta.—On December 23rd the steamship *Parramatta*, which has just been completed by Messrs. Caird & Co., of Greennock, for the P. & O. Steam Navigation Company, and which has a gross register tonnage of 4,750, went on her trial trip in the Clyde, preparatory to being handed over to the company for the India, China, and Australian mail services. The *Parramatta* averaged a mean speed of 15½ knots, showing an indicated power of 4,500 horses. The vessel has accommodation for over 200 first and second-class passengers, and is luxuriously fitted. The *Parramatta* is a sister ship to the *Ballaarat*, recently built by Messrs. Caird & Co. for the company.

Sunbeam.—This little vessel was tried lately with the most satisfactory results. She was built to the order of Messrs. Richards, Power & Co., of London and Swansea, for service on the west coast of South America, by Messrs. Cochran & Co., Birkenhead, and is fitted with a pair of inverted direct-acting high-pressure engines, and one of their patent multitubular boilers.

Mawarra.—At the end of December, the paddle-steamer *Mawarra*, which has been built by Messrs. W. Dickinson of Birkenhead, was taken out on her trial, and fully equalled all expectations as to speed and carrying power. This vessel is intended for service on the African rivers, and whilst being built more especially for towing purposes, is arranged to carry a maximum amount of cargo on her draught of 3½ feet. She has been specially designed by Messrs. Ashlin & Ashbridge for Messrs. H. Hershell & Co., of Liverpool, and is arranged so that she can be shipped on the deck of the mail steamers of this port. The machinery has been constructed by Messrs. Cochran & Co., of Birkenhead, and consists of a pair of high-pressure steeple engines, supplied with steam by one of that firm's vertical boilers made of Siemens Marten steel.

Scorton.—On December 27th, the *Scorton* (s), built by Messrs. John Readhead & Co., West Docks, South Shields, to the order of Messrs. Chapman & Miller, Newcastle-on-Tyne, had her trial trip at sea. The *Scorton* is a vessel of the following dimensions:—259 ft. by 36 ft. by 17½ ft., and is classed 100 A 1 at Lloyd's. She is fitted with compound surface-condensing engines of 150 horse-power, also made by John Readhead & Co. The vessel is fitted with all the requirements of the Grain Cargoes Act, and she will be employed in the Mediterranean trades generally. After a very successful trial at sea, she returned into the Tyne to load her cargo in the Tyne Dock.

Bulimba.—On December 29th this new screw-steamer, built by Messrs. A. & J. Inglis for the British India Association, was successfully tried at Skelmorlie. The weather was by no means favourable, but the speed of 13·35 knots which the vessel attained, was considered highly satisfactory. The *Bulimba* is a steel vessel of 2,500 tons gross register, and is intended for the British India Association's Queensland line.

Cousins Arbib.—On January 2nd there proceeded to sea from the yard of her builders, Messrs. Raylton, Dixon & Co., Middlesbrough, a screw-steamer, named the *Cousins Arbib*, built to the order of Messrs. T. & E. Arbib, of London. Her dimensions are 379 ft. over all, 35 ft. beam, 24 ft. 3 in. depth of hold, and will have a dead weight capacity of 2,800 tons. She is built of three-deck rule to the highest class at Lloyd's, has long poop, bridge, and topgallant forecastle, water ballast in both holds, accommodation for captain and passengers in poop, and is fitted in every way as a first-class merchant steamer. Her engines, of 170 horse-power nominal, by Messrs. J. Richardson & Sons, of Hartlepool, gave the greatest satisfaction at the trial trip, the vessel having attained a speed of 12½ knots. Her owners, Messrs. Arbib, with their consulting engineer, Mr. Casey, and other friends who were on board, expressed themselves highly gratified with the ship.

Rhenania.—On January 5th this steamer of 1,276 tons gross measurement, and 150 nominal horse-power, built to the highest class at Lloyd's by Messrs. Dobie & Co., of Govan, Glasgow, and engined by Messrs. Muir & Houston, for the Rotterdam mineral trade of Messrs. W. H. Muller & Co., and designed to combine large carrying capacity with a good rate of speed, left the harbour for a preliminary trial of her machinery, and the official trial was run satisfactorily with the representatives of the company on board.

Violante.—On January 9th Messrs. Edward Finch & Co., ship builders, ran a trial trip of another new steamer, the *Violante*, built to the order of Messrs. Cuthbert, Hancock, & Co., of Cardiff, and of the following dimensions:—Length, 200 ft.; breadth, 30 ft.; depth of hold, 15 ft. She is fitted with compound surface-condensing engines of 80 nominal horse-power, also steam winches, and Emerson & Walker's patent windlass, and is built to the highest class at Lloyd's. She has every modern appliance for economy and despatch in working. After a most satisfactory run, in rough weather, of about ten hours, she arrived in the Alexandra Dock, Newport, where she is to load for Bilbao.

Lauderdale.—On January 10th this steamer went down the Firth of Clyde on her trial trip. The company invited by the owners joined the vessel at the Tail of the Bank, from which she proceeded to the "measured mile" off Skelmorlie. The day was most unfavourable for a trial trip, as it was blowing half a gale, accompanied with heavy rain. The new vessel, however, stood the test remarkably well, and attained a speed of eleven knots per hour. During the run the engines developed 1,200 horse-power, with 75 revolutions per minute, and showed a pressure of 80 lbs. of steam. The cylinders are 38 and 66 in. in diameter, with a 42-inch stroke of pistons. The entire ship is built of steel, and she has two boilers of the same material. She was built by Mr. Wm. Thomson, Whiteinch, and engined by Messrs. Rankin, & Blackmore, Greenock. Dimensions:—Length, 265 ft.; breadth, 36 ft.; depth, 22½ ft.; gross tonnage, 1,790 tons; deadweight carrying capacity, about 2,800 tons. She has been built to the highest class at Lloyd's, with complete cellular double bottom and six watertight bulkheads. Messrs. Bow, M'Lauchlan & Co.'s steam steering gear has been fitted amidships, and Chadburn's patent telegraph has been adopted to communicate between bridge and engine-room. On the forecastle a powerful steam windlass, with capstan, is provided for working the anchors. She has been built to the order of Messrs. Robert Mackill & Co., steamship brokers, 29, Waterloo Street, Glasgow, and will form a suitable addition to that firm's Dale Line, being the largest carrying the company's flag between that city and Jamaica. In addition to her extensive cargo-carrying capacity, she is fitted up for accommodating a limited complement of first-class passengers, and commanded by Captain David Ormistone.

Beeswing.—On January 6th the fine new screw steamer *Beeswing* was taken upon her trial trip at sea. The steamer has been built by Messrs. Dobson & Charles, Grangemouth, for the Universal Steamship Co. (Limited), London. Her dimensions are:—Length, 230 ft.; breadth, 33 ft.; depth, 16 ft. The vessel, which is built entirely of steel, has been constructed under the personal superintendence of Mr. J. F. Flannery, consulting engineer, of London, to take the highest class at Lloyd's. She is fitted with Davis's steam steering gear amidships to the upper and lower bridges, and has an unusually large outfit of spare gear. Her engines, which are built by Messrs. Hutson & Corbett, of Glasgow, are 120 nominal horse power, the cylinders being respectively 27 in. and 53 in. in diameter, and the piston stroke 36 in., and working at a steam pressure of 70 lb. per square inch. The average speed attained on the trial trip was 10½ knots.

Esk.—On January 20th the new stenmer, *Esk*, built by the Barrow Shipbuilding Company, for the Royal Mail Steam Packet Company, London, was sent for a preliminary trial over the new measured-mile course opposite Seascale on the Cumberland coast. The vessel left the Ramsden Docks, Barrow, at about eight o'clock in the morning and, after adjusting her compasses, proceeded northwards to make her trial. The speed realised was about twelve and a quarter knots, which, under unfavourable conditions of trim, &c., might be considered satisfactory. On the following day the vessel, having in the meantime been lightened and trimmed to her intended load line, again proceeded to Seascale, but, owing to the foggy weather, the posts marking the mile course could not be discerned.

Hilda.—On January 13th a new steamer named the *Hilda*, built for the London and South-Western Company, was taken to Stokes Bay for an official trial at the measured mile, when she realised a mean speed of 16 miles per hour. This vessel is intended for the Channel Islands mail service.

Manuel L. Villaverde.—On January 15th the official trial trip of this screw-steamer took place at Wemyss Bay, when she obtained a mean speed of 14 knots per hour, everything being most satisfactory as regards the working of the machinery. This vessel has been built by Messrs. Lobnitz & Co., Renfrew, to the order of the Campania Transatlantica (late Messrs. A. Lopez & Co.), of Barcelona and Cadiz, to run in connection with their main mail and passenger line from the Peninsula to Havana and Vera Cruz. The steamer has been arranged and constructed under the superintendence of Captain Ugarte and Mr. Coleman, the superintendent of the company, and is fitted up for 60 first-class and 30 second-class passengers, and has also accommodation for third-class passengers and troops. The vessel and machinery are classed at the highest class at Lloyd's.

C .W. Eborall.—On January 19th the iron twin screw-steamer *C. W. Eborall*, which has been constructed by Earle's Shipbuilding and Engineering Company, Limited, for the South-Eastern Railway Company's Channel service between Folkestone and Boulogne, was taken out on her trial trip. The result was highly satisfactory both to the builders and to the owners' representatives, who were on board, the speed, as taken on the measured mile, being half a knot more than was stipulated in the contract, viz., 12½ knots instead of 12 knots. We gave an outline description of this vessel at the time she was launched, but may here mention that she is a sister vessel to the Folkestone and Boulogne, which were built by Earle's Company for the same owners, her dimensions being 190 ft. long b.p., 25 ft. beam, and 12 ft. depth of hold, and the power of her engines 110 horse-power nominal.

THE *Lightning*, one of the earliest torpedo boats supplied by Messrs. Thorneycroft to the service, has been subjected to a series of progressive speed-trials at Portsmouth, under the superintendence of Chief Engineer Castle, of the Steam Reserve. The steering power of the craft, which is otherwise satisfactory, has always proved defective in consequence of the wide circle which she required to turn in. In order to surmount the difficulty the propeller has recently been encased in a tunnel; but while it was thought that the device might improve her handiness in going round, it was feared that it might detract from her speed. Trials were accordingly ordered to be made upon the measured mile in Stokes Bay, for purposes of comparison with the speed which she realized with the original propeller. Four runs were made at full speed, 14 knots, 12 knots, and 10 knots. When tested to the utmost a mean speed of 16·5 knots was obtained, or about half a knot less than under the old conditions. The horse-power developed, however, was also less, and as this is supposed to be due partly to the inferior character of the coal used, and partly to the fuel being forced over the bridge and so choking some of the boiler tubes, it is probable that further runs will be ordered. The steering in circling and going ahead was better than before, but in steering with the engine going astern the results were less satisfactory than with an open screw.

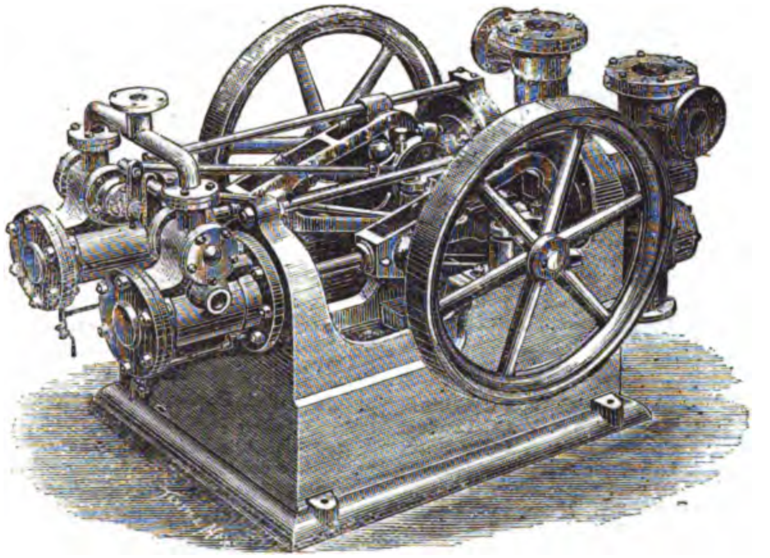
TRIAL TRIPS.—German.

Prinz Alexander.—This steamer, built for the Anglia Company, of Hamburg, by the Germania Shipbuilding Company, Kiel, made her trial trip on the 14th inst., and realized a speed of 10·7 knots per hour, which was considered highly satisfactory. The engines, by Messrs. Egells, of Berlin, worked extremely well.

Mereo.—On December 23rd the new built spar-decked vessel *Mereo*, made her trial in the Flensburg Bay. She is built for Messrs. H. Schuldt & Co., shipbrokers at Flensburg, and has the highest class in Bureau Veritas. Her dimensions are :—212 ft. by 29 ft. 8 in. by 22 ft.; compound engines, 400 indicated horse-power. A company of about 70 gentlemen partook in the trial trip, where everything worked to the utmost satisfaction, the vessel making an average speed of 10¾ knots. This is the tenth steamer which is finished this year by the Flensburg Shipbuilding Company, in all, 12,200 gross registered tons.

HANSON'S IMPROVED HORIZONTAL STEAM PUMP.

THESE pumps, either single or double, have been designed with a view to meet more fully requirements which have hitherto been overlooked or neglected. The maker has for a great number of years had considerable experience with almost all kinds of steam pumps, during which time he has continually watched the causes of breaking down, or weakness in different parts of their machinery, and from time to time successfully made good any defects by judiciously giving additional strength, and at the same time retaining the necessary compactness and ease of access to all its parts. The illustration we give conveys a good idea of the general arrangement of this kind of pump. From this it will be seen that the machinery is all fixed to a strong cast-iron bed, which is so arranged that any water leakage from the stuffing boxes is caught and drained away. To prevent breakage, which frequently occurs in ordinary pumps, the crank shaft is made much stronger than usual; all the glands and stuffing boxes are bushed with brass; all the necks and connections are unusually large, to prevent the large amount of wear and tear which exists when small necks are used. The valves all work vertically, and are made the same size as the pump plunger on the suction side. These pumps are suitable for pumping water for all purposes, for feeding boilers, and for steam fire engines; and from the view given, the compactness of their construction, together with the ease with which all parts may be examined and attended to, will be at once apparent.



HANSON'S IMPROVED HORIZONTAL STEAM PUMP.

New Shipbuilding Yard at Howdon.—We are glad to be able to announce, in connection with the development and extension of iron shipbuilding on the Tyne, that in addition to the contemplated new yards at Wallsend and Elswick, another new yard is to be commenced at Howdon. Messrs. H. S. Edwards & Sons, the well-known ship repairers of the graving dock, South Shields, are the firm about to open out business at the place named, having secured a large plot of ground on lease from the Duke of Northumberland, for the purpose of commencing iron shipbuilding. The site chosen is immediately adjoining the Tyne Commissioners' yard at Howdon, and extends eastward down to the staithes of the Cramlington Coal Company. The ground is adjacent to the Newcastle and North Shields turnpike, is but a short distance away from the riverside railway, and has a splendid river frontage Arrangements have already been made for the construction of all necessary buildings in connection with the undertaking, and the requisite machinery will be placed on the spot in time to permit of shipbuilding operations being commenced shortly after the beginning of next year.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

December 23rd, 1882.

Alderson, Joseph	2 C	Cardiff.
Baker, Wm. H.	1 C	London.
Bell, David R....	2 C	do.
Birch, John E....	1 C	Sthmptn.
Craig, W. R. S.	2 C	N Shlds.
Cummings, John	2 C	Cardiff.
Dixon, George C.	2 C	N Shlds.
Elliott, Charles E.	2 C	London.
Eyre, George ...	2 C	Cardiff.
Fraser, Alex. ...	2 C	N Shlds.
Hackett, John E.	2 C	Lvrpool.
Haddy, S.	2 C	London.
Hunt, John	1 C	Lvrpool.
Jesseman, Wm.	2 C	N Shlds.
Jones, John	1 C	London.
Jones, Robert ...	1 C	Lvrpool.
Kitching, Alfred	2 C	Hull.
Lee, James C. ...	2 C	Dundee.
Lister, A. M. ...	2 C	Lvrpool.
Macardle, James	2 C	do.
Marsh, Edward	2 C	Cardiff.
Millar, Patrick ...	2 C	Dundee.
Patrick, Archibd.	2 C.	Lvrpool.
Pearse, R.	2 C	do.
Quayle, Charles ..	2 C	do.
Rintoul, A., Master of his own fore and aft yacht		Glasgow.
Robertson, W. I.	2 C	N Shlds.
Sharp, John, Wm.	2 C	do.
Smith, Thomas	2 C	Cardiff.
Soutar, Robt. ...	1 C	London.
Swainston, Rchd.	2 C	N Shlds.
Thoburn, John G.	2 C	do.
Thorburn, Geo. E.	2 C	Lvrpool.
Travers, Robert	2 C	Cardiff.
Tyler, George B.	1 C	London.
Wardale, A. W.	2 C	Hull.
Watson, M.	2 C	N Shlds.
Watson, J..........	1 C	Lvrpool.
Weldon, J.	1 C	do.
Williamson, J. H.	2 C	N Shlds.
Wilson, John ...	2 C	Hull.
Wilson, Thos. A.	2 C	Cardiff.

December 30th, 1882.

Allan, James ...	2 C	N Shlds.
Amess, John......	1 C	do.
Bampton, Harry	1 C	Glasgow.
Biggam, Peter ...	2 C	Lvrpool.
Dick, John	1 C	Glasgow.
Duffy, Owen F.	2 C	Lvrpool.
Dyble, Charles...	2 C	N Shlds.
Flack, George ...	1 C	Livrpool.
Forsyth, Dav. H.	2 C	Glasgow.
Gibson, John ...	2 C	do.
Glaholm, James	2 C	Sndrlnd.
Hamlen, Charles	2 C	Lvrpool.
Hill, George	2 C	N Shlds.
Humble, Geo. F.	2 C	do.
Hutchings, A. G.	2 C	London.
Kinnear, John ...	1 C	Lvrpool.
Lynas, Michael...	2 C	do.
Macnab, Robert	1 C	Glasgow.
McMillan, George	1 C	do.
Miller, John	1 C	Lvrpool.
Morrison, Jas. H.	1 C	Belfast.
Oliphant, James	2 C	Lvrpool.
Oliver, William	2 C	N Shlds
Ryder, Charles L.	2 C	do.
Sand, August ...	2 C	Sndrlnd.
Simpson, Steven	2 C	Glasgow.
Smart, A. G. ...	1 C	Lvrpool.
Spiers, M.	2 C	London.
Stewart, William	2 C	Glasgow.
Taylor, John ...	2 C	do.
Williams, T. J.	2 C	London.
Williamson, D.	1 C	Aberdn.
White, M.	1 C	Glasgow.
Wyllie, James A.	1 C	do.

January 6th, 1883.

Dodds, Peter ...	2 C	Leith.
Ferguson, James	2 C	do.
Griffiths, Thos.	2 C	London.
Harrow, Richd.	1 C	Leith.
Heron, Thos. M.	1 C	N Shlds.
Manthorpe, J. M.	1 C	Leith.
McLennan, John	1 C	do.
Monroe, Wm. ...	2 C	do.
Morris, Thomas	2 C	do.
Napier, Richard	2 C	do.
Pease, James C.S.	1 C	Bristol.
Robertson, H.C.J.	1 C	N Shlds.
Smith, Richard	2 C	London.
Stewart, Charles	1 C	N Shlds.
Sturrock, William	2 C	do.
Thom, Archibald	2 C	Greenock
Thomas, W. J.	2 C	Lvrpool.
Torrie, Wm. ...	1 C	N. Shlds.
Wheeler, R. A.	2 C	Bristol.
Wilson, Robt. ...	2 C	Leith.
Winnons, John...	2 C	Bristol.
Young, Alex. ...	2 C	Leith.

January 13th, 1883.

Alexander, C. W.	2 C	Leith.
Boyd, Arthur ...	2 C	London.
Cowing, Matt. ...	2 C	N Shlds.
Dalrymple, AMQ.	2 C	Glasgow.
Dawson, Septims.	2 C	London.
Dodridge, Henry	2 C	do.
Fish, Thomas W.	2 C	do.
Gibb, William ...	2 C	Glasgow.
Harrison, Hills...	1 C	Hull.
Hayward, John M.	2 C	Livrpool.
Ivison, Thomas...	1 C	Glasgow.
Johnston, David	1 C	do.
Langler, Geo. ...	2 C	London.
Martin, James ...	1 C	Glasgow.
Mollison, Ronald	1 C	London.
Neill, Wm	1 C	Glasgow.
Richards, Thos. H.	1 C	London.
Vivian, Chas. A.	2 C	Plymth.
Wallace, Robt. H.	2 C	Glasgow.

January 20th, 1883.

Awburn, Thos....	1 C	N Shlds.
Belford, Wm. ...	1 C	Sndrlnd.
Bennett, George	1 C	Hull.
Berry, Edwin ...	1 C	London.
Butterworth, G.H.	2 C	Lvrpool.
Castle, John P.	2 C	London.
Cooper, James W.	1 C	N Shlds.
Douglas, Wm. W.	1 C	Dundee.
Happle, Robert	2 C	Sthmptn.
Henderson, Mat.	2 C	N Shlds.
Hirst, Abrhm. F.	2 C	Hull.
Jones, John S....	2 C	N Shlds.
Knowles, John...	1 C	Lvrpool.
Lightburn, John	2 C	do.
Lilienthal, John	2 C	N Shlds.
Martin, Robert...	1 C	Hull.
McLardy, John H.	2 C	N Shlds.
Milligan, Andrew	1 C	London.
Morley, John ...	2 C	Lvrpool.
Morris, Hugh ...	2 C	do.
Oglesby, Henry	2 C	Hull.
Sampsom, Wm.	2 C	Lverpool.
Sime, James	2 C	N Shlds.
Smithers, T. J.	2 C	London.
Spence, Chas. M.	2 C	Dundee.
Sturrock, James	2 C	London.
Taylor, Wm. ...	2 C	Cardiff.
Woodliff, H. D.	2 C	do.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from December 21st to January 20th.

6079 G. de Laval. Facilitating the propulsion of ships.
6084 A. Zalm. Regulators for steam-engines.
6112 A. L. B. Duher. Safety boat.
6116 J. C. Lake. Steering apparatus.
6216 J. Armer. Tubular boilers.
6222 A. Bradshaw. Cocks or valves.

1883:—

8 J. Howden. Fuel combustion.
12 D. Wellington (communicated to H. J. Haddan). Ship toilet apparatus.
28 T. Rowan. Cargo transit.
29 W. Hall. Utilising waste heat.
35 W. H. Harfield. Wire rope coiling reel.
47 S. Heimann. Mariner's Compass and registering device.
48 Safety gear for starting or turning engines.
57 T. Duff. Lubricators.
65 C. Ingrey & W. Adlam. Motive power engines.
67 R. E. B. Crompton & J. W. Kempster. Steam-engine governors.
70 G. Allibon & T. Turton. Crank and other shafts.
72 A. A. Daussin (communicated to H. J. Haddan). Generating steam and obtaining power.
75 C. H. Parshall (communicated to W. P. Thompson). Oiling Crank pins, &c.
110 R. A. Messervez (communicated to H. J. Allison). Refrigerators.
118 J. Chapman. Surface condensing engines.
136 J. N. Paxman. Governors.
138 C. A. Barber. Attracting and slaying fish, &c.
140 M. H. Smith. Boilers.
176 C. H. Parshall (communicated to W. P. Thompson). Lubricating cylinders, &c., against resisting pressure.
186 A. H. Williams. Preventing entry of water into fractured compartments of ships.
188 J. Aimers & J. Finline. Valves and valve gear.
189 W. Alexander. Sheaves for pulley blocks.
201 J. R. Wells. Compound steam-engines.
203 W. Rockliffe. Hand-rail stanchions.
209 H. Lane. Steam generators.
216 E. B. Donkin. Rotary pumps.
219 G. F. Fuller. Grapples, skips, &c.
245 J. H. Barry. Anti-fouling and preservative composition.
258 G. Keith (communicated to J. Munro). Governor.
260 J. S. Birch (communicated to P. M. Justice). Centre board vessels.
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NOTICE.

All Contributions and Books for Review should be addressed to the EDITOR, W. G. Neal, 3, Amen Corner, Paternoster Row, London, E.C. All Communications must be accompanied by the name of the sender, not necessarily for publication, but as a guarantee of good faith. The return of rejected communications cannot be guaranteed, nor will the Editor be answerable for the loss of any MSS.

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The Marine Engineer.

LONDON, MARCH 1, 1883.

EDITORIAL NOTES.

In spite of the serious views entertained by Admiral Symonds, Sir E. J. Reed, and others of high authority in the House of Commons as to the comparative inefficiency of the British Navy to cope with possible combinations of foreign navies, we find that Mr. N. Barnaby, the Admiralty Director of Naval Construction, can present a very fair report of the state of our Naval Resources. This he has done in an interesting paper, read at the Royal United Service Institution, under the presidency of Admiral Sir Astley Cooper Key. Mr. Barnaby showed, by comparative diagrams, that England's Naval power in ironclads nearly equals the combined powers of France, Italy, and Germany, as at present existing. This is encouraging; but we think still more of his views, that the future favourite weapons for the protection and destruction of commerce will be armed vessels of the same character. As sea-going cruisers for general purposes, there is little doubt in our mind that the great capacity for carrying coal, and high speed of our mercantile liners will prove the most valuable accession to our fleet in case of emergency. So far from joining in the French and Italian craze for enormous size, Mr. Barnaby thinks that gun-vessels, with numerous long-range shell guns, and costing not more than one-fourth of the modern battle-ship, will displace the battle-ship for many services, such as the infliction of damage upon shipping which may be under the protection of land fortifications. We think Mr. Barnaby's views very sensible on this point; and, when we realise the enormous and increasing cost of our present iron-clads, and the ease with which they may be sent to the bottom by an unlucky torpedo or collision, it certainly begins to look like having too many eggs in single baskets.

We are interested in noting, for the benefit of others, that a praiseworthy move in the employment of female labour as draughtswomen, has been made by many firms on the Clyde. Messrs. Clarke, Chapman, and Gurney, at Gateshead, commenced to make the experiment about twelve months ago, giving the ladies separate and special accommodation. So satisfied have the firm been with the result of the experiment, that they are about introducing additional lady clerks. Messrs. Swan and Hunter, Shipbuilders on the Tyne, are also preparing to follow suit in this way. We do not consider that this is any way a superseding of masculine labour, as the ladies in the drawing-office are necessarily restricted to mere mechanical tracing of drawings, or the finishing of drawings already prepared for them by the draughtsmen. If female labour in the mere mechanical reproduction of drawings should entirely displace the boys and young men now so generally used as "tracing clerks," we should think it a very good thing for the said boys and men if it drove them into the practical works. Far too many of our so-called mechanical draughtsmen have been brought up as tracing clerks, without any practical experience; and who consequently are never fit to be anything else, Draughtsmen, to be be worth the name at all, should be intimately and practically acquainted with whatever they have to draw or design, and, on this platform, cannot possibly suffer by competition from female labour. The neatness, celerity, and taste of females, on the other hand, may well find its place as a supplement to the designing draughtsmen, in tracing and the artistic finish of drawings, or even the improvement of artistic outlines and details of ornamentation.

THE Italian Government is most energetically pushing its experiments with their large 100-ton guns against a variety of armour plating. Plates, 19 in. in thickness of steel or steel faced, have been completely shattered by the impact of these guns at what may be considered fairly close quarters. The 100-ton breech-loaders were fired with 771 pounds of powder and a 2,000 pound shot. The velocity of the shot was 1,834 feet per second, and the energy resulting amounted to 46·700 foot tons. This development is about 50 per cent. in excess of that from our 80-ton guns; and, as Italy has eight 100-ton guns afloat, as compared with our four 80-ton guns, she has at present much the advantage in absolute weight of metal. Whether the general value of a fleet for general offensive and defensive action improves in the ratio of their weight and unwieldiness both of guns and vessels is, however, still an open question. See, for instance, the destruction of the Italian fleet by the Austrians; also the effective action of the little *Condor*, against much heavier metal in the Mex Forts. If the relative increase of guns and armour is still to progress, as up to the present, the prospect is a startling one. We think that a new departure entirely may be taken in the construction of an ironclad which shall be constructed of such lines that a shot in any direction would be deflected rather than directly opposed; and of such internal strength as to make the partial indirect blow of any shot or shell comparatively innocuous. We are astonished that so little has been hitherto done in the direction of attempts to divert, by deflection, or elasticity, or both combined, the destructive effect of impact. As for instance, given a cylindrical body with a double skin; the inner being rigid and strong, and the outer elastic, supported in position on the inner shell by a thick padding of compressed cotton; the elastic power of resistance of such a compound shell to the impact of a shot would be almost infinite, whilst, at the same time, the weight of compound skin would be little more than that of the water it displaces. The cotton would even serve, being lighter bulk for bulk than water, to render the floating cylinder self-supporting, even if the double skin were pierced. It seems to us that there is a big field open in this direction.

THE rudder of the *City of Berlin* was carried away in a recent storm, and a new one was forged at the works of the Paterson Iron Company for it, in the United States. As it is reported to be one of the biggest forgings ever turned out there, they have made some fuss about it. Of course the job was interviewed by the press reporters, and graphic details of the operations and parts have been given. The shaft is 40 ft. long, and the blade 25 ft., the whole weighing about 9 tons. The strength is given to the rudder in the framing, which is formed of a wrought bow, about 8 in. square, welded to the post at its two ends. The faces are plated and the interior filled with resin. As a false weld or flaw would ruin the whole structure, the best hands are chosen for such a job; and the Paterson Iron Company have to pay 12 dols. a day to the leading hand on the job. Such wages would make the mouth of some of our leading mechanics water.

IT seems that great importance is attached to the construction of a new dome-deck ship *Meteor*, which has been recently launched from a ship-yard at Myack, on the River Hudson. The *Meteor* is said to possess the invaluable qualities of great speed, carrying capacity, self-righting, and unsinkableness. These qualities are so evidently desiderata in the mercantile marine, that if this remarkable vessel developes the 23 to 25 miles an hour expected of her, and shows the other qualities as well, there is little doubt that she will revolutionise the lines and construction of our Merchant Navy. There is, however, many a slip between the cup and the lip, and this would be by no means the first invention, especially from America, which was going to set the Thames on fire, but has evaporated in smoke before reaching us. However, we are quite disposed to believe that increase of speed will naturally tend to increase as times go on, as it has hitherto done, though accompanied by the great draw-back of increased storage of coal required. Much importance is attached, in a hasty manner, by inventors to variations in the lines and run of a vessel, as about to produce an entire radical change in the speed of cargo vessels, without diminishing their carrying capacity or other qualities. We think this idea is evidently fallacious, except in a very minor degree, if it is realised that the chief resistance to vessels driven through the water is due to surface friction. As the displacement of cargo carried must be the same, whatever the lines of the vessel, except inasmuch as the ship itself may be lightened, the surface friction cannot be much affected. In fact, a plain cylinder represents the section which contains the largest volume with the least amount of surface area. That, step by step, better speed, economy in driving power, and better security against foundering, under stress of weather or damage by collision, will be obtained, we firmly believe, but it will be probably by here a little and there a little, rather than by any radical convulsion. We shall, however, watch the trial of the *Meteor* with interest.

It is a matter of some surprise to us that, seeing the elaborate arrangements that are made now, in both our Navy and in the Mercantile Marine, for supplementing and aiding the manual labour on board, that nothing has been done to supply the fuel automatically to the furnaces. When we find that the weight of fuel to be supplied to the furnaces on board our ironclads or largest liners amounts, in many cases, to two or three hundred tons a day, it seems to us that the mere handling and bringing of this fuel to the furnaces, represents the largest item of daily labour in the vessel. As automatic boiler stokers are already largely and successfully applied to land boilers, we do nor see any reason why they should not be adapted to marine boilers, and have, in combination, automatic creepers, or a small overhead trolley-road, by which the coal could conveniently be brought to the furnaces.

CASUALTIES AT SEA.

CONTINUING this important and pressing subject from page 258, we would consider the special and appalling class of disaster of foundering. No accident which can befall a vessel is so difficult to understand and so much needs special attention as that we refer to. When any great calamity occurs, such as the collisions in the cases of the *City of Brussels* and the ill-fated *Cimbria*, a body of scientific experts generally decide the quarter to which blame should be attached, and from their reports and evidence inventive mariners and others propose new rules and improvements, which, if applied, tend to diminish the probabilities of similar casualties. In the case of a vessel running on shore, the inquiry held as to the cause of loss or damage, often proves that unseamenlike mismanagement or some other preventable agency, is wholly responsible for the temporary damage or total loss of the ship. Many other casualties which occur, causing partial disablement or total loss, may be traced to the breaking of crank shafts, loss of rudder, carrying away masts and spars, and other causes, which are easily explained, and every effort made in future arrangements and appliances to overcome the weak points which were proved to exist in each case. So long as the seafarer and the interested public can understand the direct cause of any casualty, and can be led to believe that it is possible to provide against a recurrence of such in the future, their faith in the manufacturing and navigating skill of our Marine professions remains to a certain extent unshaken.

When, however, very large vessels, with plenty of sea-room, go to the bottom from their incapability to ride out an ordinary gale, and in some instances the extraordinary fact is recorded that a portion, if not all, of the crew and passengers are able to weather the storm in some of the fragile boats belonging to these vessels and reach the shore, or some friendly passing ship in safety, the public mind is distressingly exercised to know how these astounding disasters are to be accounted for. It stands to reason, that if a large ship is properly built and handled she should prove herself in a very great degree much more safe in any storm of whatever severity, than the best boat in only a stiff breeze of wind. On account of many such losses as referred to being well known to those who study shipping interests and reports, we need not multiply words in explaining the urgent necessity of directing attention to this class of calamity.

In the event of the whole or a portion of the crew being fortunately saved from sharing the untimely fate of the vessel in which they sailed, it is not unfrequently elicited from them in the inquiry which follows, that some structural defects existed in the ship which led to its destruction, or some vital precautions specially provided for additional safety had been most negligently overlooked.

The most deplorable loss, however, which occurs, and the most difficult of all to explain is the entire disappearance of a vessel and all hands; and it is only by carefully studying and considering the evidence of those saved from vessels known to have foundered, that we are persuaded to believe that a great number of vessels which are continually posted *missing*, have foundered from defects which might have been remedied or which should have never existed. As the integrity and reputation of many important firms, societies, and individuals is seriously affected according to the nature and cause of such fearful losses, in the event of their culpability being proved, the most careful consideration should be exercised in arriving at direct conclusions as to apparent or undeniable causes.

A daily contemporary, under the heading "Co-operation which is not for the public benefit," says, "it is not too much to say that thousands of sailors have lost their lives during the last ten years, because shipowners are recklessly negligent of the duty of providing for the capability of their ships to withstand the extraordinary risks of a sea voyage. The keen competition to which shipowners are subjected, makes the temptation to reduce the expenditure necessary for the building, maintaining, equipping, and manning of their ships to the very lowest point consistent with the bare requirements of the underwriters' surveyors. It is not too much to say, that in the ordinary way of business the loss of a ship with all hands does not affect the insured owner in a pecuniary sense. The freight of a ship is insured in the same manner as the hull, so that the owner receives the proceeds of the voyage, whether the ship is lost or not; and if she goes to the bottom with all hands, he has less wages to pay to the widows and representatives of the crew than if she came into port, besides escaping many other expenses, and being able to provide himself with a new ship."

It is a very comforting matter to unscrupulous owners to be able to ensure themselves against any pecuniary loss, and, in fact, to profit by such; but it is most alarming to the general maritime public to know that this can be done. There is no doubt that, owing to the great increase in our shipbuilding trade, commerce, and competition, during the last two or three years, many unprincipled speculators have endeavoured to realise the greatest profits from the smallest possible outlay. To effect this, these unscrupulous owners must most cleverly manage matters so as to avoid detection by Lloyd's Surveyors, the Board of Trade Surveyors, and other officials, or these authorities must, to some extent, willingly blind themselves to the actual deficiencies of many important requirements.

These are most alarming statements, and many of our genera readers might imagine they are to some extent overdrawn. There are, however, amongst our readers, some who are painfully aware of the existence of the state of things we are anxious to draw attention to, viz., that shoddy ships are built, that bad plating, and bad rivetting, is passed by surveyors, that vessels with most glaring defects receive the highest class for efficiency and seaworthiness in various registries and societies, that they go to sea heavily insured as trustworthy structures, and as soon as they meet with heavy weather they either have to be abandoned in a sinking condition, whilst the crew are able to keep afloat in small boats until rescued, or they founder so suddenly that nothing more is heard of the ship or crew.

Of course, we do not infer that every vessel lost in mid-ocean necessarily founders on account of defective workmanship or material embodied in her structure. There are several causes of foundering at sea, all of which should be carefully considered.

The first is that of shoddy work, then such causes as shifting of loose cargo, bad stowage, over-loading, spontaneous combustion of coal or cargo, and fire. Immunity from each and all of these dread disasters is more or less provided against, but by carefully considering what is supposed to be done in each case, how little in many cases is actually done, and how badly this little is done, we hope to convince our readers and the public generally that many great and additional improvements may be made to provide for the greater safety of the lives of our toilers on the sea, and of those whose business compels them to cross the briny ocean.

The question as to the existence of shoddy work, sham surveys, and coffin ships, so frequently dispatched to sure destruction, has lately been brought rather prominently before the public, to the apparently pious horror and virtuous indignation of shipbuilders, owners, and surveyors. We find that the broad statements which have created such astonishment and alarm in the shipping world, possess a much better foundation than at first sight could have been imagined. The fact that newly-built vessels before making a single voyage have been found to be leaky, and docked for extensive repairs to their hulls, and that many ships, after a first voyage, show most distressing signs of weakness and unseaworthiness, is enough, in itself, to call public attention and indignation to the cruelly neglectful condition in which vessels are passed and allowed to go to sea, and furnishes us with an undeniable proof that many such shoddy ships as are now and again reported missing, go to the bottom on account of the bad manner in which they have been built.

Our readers might ask are these vessels classed, and if so, where are Lloyd's Surveyors, the Board of Trade Surveyors, and other authorities, whose watchful scrutiny and impartial reports and decisions, are supposed to be such a good and secure guarantee of every requirement being carried out to the letter. We are compelled to say, that either the utmost neglect and indifference is continually practised by such supposed protective authorities, or much worse still, many such official scrutineers wilfully connive with the builders and owners in the construction of cheap and shoddy ships, which by means of their misleading reports receive the highest class in Lloyd's Registry and the Bureau Veritas, as the most seaworthy vessels; and at our Admiralty, as extra strong ships, to be used as fighting cruisers in the event of their defensive services being required.

We would here explain, it is not our intention to imply that shipbuilders, surveyors, &c., are, as a whole, entirely untrustworthy, and that all ships are necessarily floating coffins, but that purely, in the interests of humanity, it is our desire to prove that in each of these representative bodies black sheep are to be found, who, by sheltering their evil transactions, under the traditional integrity of our great shipbuilding authorities, succeed in obtaining contracts at prices so low, that their tender alone would suffice to prove to any practical being the impossibility to supply material and workmanship sufficiently good, to provide for the safety and seaworthiness of the vessels they build. Then follows the fact, that this inferior material and work is passed as being worthy of the highest class by surveyors, whose duty it is to detect and expose everything approaching this state of imperfection.

To satisfy ourselves that this state of things exists to a very serious extent, we have carefully collected particulars from various repairing firms throughout the kingdom, of the shameful condition in which new vessels have been placed on slipways and in dry dock, to undergo extensive alterations and repairs, these vessels having received the high class we refer to, as being noble and pattern structures of the most reliable description.

In the course of the necessary repairs in different cases, thousands of leaky rivets have been discovered, fractured and indifferent plates have been removed, and, in some instances, most extensive additional strength has been found necessary. How, then, does this come about, that vessels built under special rules and survey, and guaranteed as of the highest order, are found, when only a few months' old, to be fragile, leaky, and in every respect entirely inferior and worthless? or, in other words, how is it that shoddy ships of the most slop-built nature, receive the highest classes and certificates in registry offices and societies; and is it a matter of surprise that under such circumstances, when a vessel is reported missing, she should be supposed to have sunk on account of glaring imperfection in her construction. Even if only a suspicion was entertained that such unjust transactions, of a most isolated character, were likely to occur, it would become a most important duty that honest professional authorities, for the sake of their own interests and protection, should endeavour to expose the guilty parties; but when the undoubted fact is forcibly brought home to us that such proceedings frequently occur, and that they appear to be on the increase, then the absolute necessity of a searching inquiry and exposure is seriously required; and we hope that *bona fide* shipbuilders, surveyors, and other authorities, will assist us in our endeavours to protect their interests. In continuing this important subject, we purpose referring in detail to the methods of designing, estimating, constructing, surveying, repairing, owning, and insuring, in which, from many facts already in our possession, we will fully prove much more than herein stated, and satisfy the most unbelieving that some builders, surveyors, and owners, should not unfrequently be placed on trial for nothing short of culpable manslaughter.

TECHNICAL EDUCATION IN NAVAL ARCHITECTURE.

THE first elementary principle concerning the flotation of a ship in the water is this, that when she is afloat she is Displacing as much water as would weigh exactly equal to the weight of the ship herself. This is the celebrated law that was discovered by Archimedes, when he rushed out of his bath, in undress, crying "Eureka!" (I have found it!) The tale, as told by Dr. Brewer, is that "Hiero, king of Syracuse, delivered a certain weight of gold to a workman to be made into a votive crown, but suspecting that the workman had alloyed the gold with an inferior metal, asked Archimedes to test the crown. The philosopher went to bathe, and in stepping into the bath, which was quite full, observed that some of the water ran over. It immediately struck him that a body must remove its own bulk of water when it is immersed, and putting his idea to the test, found his surmise to be correct. Now, then, for the crown. Silver is lighter than gold, therefore, a pound weight of silver will be more bulky than a pound weight of gold, and being of greater bulk will remove more water. Vitruvius says: When the idea flashed across his mind, the philosopher jumped out of the bath exclaiming, 'Heureka! heureka!' and without waiting to dress himself, ran home to try the experiment."

There is another fact, however, in connection with Archimedes that is perhaps not so often repeated relating to this discovery, viz., that he himself was either directly or indirectly connected with the building of at least one enormous ship, as great a phenomenon for the times, or perhaps greater than the *Great Eastern* or the *City of Rome*, or other huge vessels of the present day. In fact, I may perhaps again digress here, to mention what may not be known to all my hearers, that this period, about 2100 years ago, is the only epoch of which we read between the time of the Ark (which was unquestionably a monster for her times) and the present day (when monsters in ship construction are becoming familiar), when we have anything to compare in size either with one period or the other.

It would be a curious matter to speculate upon the reasons which induced Hiero, king of the small territory of Syracuse, and guided by a man of genius like Archimedes, to vie in the construction of huge floating structures with the kings of Egypt of the time, namely, the Ptolemies. The small craft which the Phœnicians—better known in Scripture as the Philistines—had multiplied on the Mediterranean in pursuance of the earlier aspirations of their ancestors, or supposed ancestors, the Chaldeans, on the Persian Gulf, in earlier times, could have given no encouragement to the hope of such huge monsters being properly managed with oars, or being commercially successful. The Phœnicians were practically a maritime people, founding cities on the shores of the Mediterranean, of which Carthage and Marseilles are notable examples, and extending their trade as far as Cornwall, from whence they exported tin, but they never indulged in such excesses for mere purposes of display.

The Egyptians, we know by their Pyramids, Obelisks, &c., were given to great display, and this may account for the large galleys culminating in the enormous vessel known in history as having been built by Ptolemy Philopater, of which the following leading particulars are given by Sharpe:—She was 420 feet long by 57 feet wide, with 40 banks of oars. The longest oars were 57 feet long, and weighted with lead at the handles that they might be the more easily moved. This huge ship was to be rowed by 4,000 rowers, its sails were to be shifted by 400 sailors, and 3,000 soldiers were to stand in ranks upon deck. There were seven beaks in front by which it was to strike and sink the ships of the enemy.

The Syracusans were not nominated by similar productions, so far as history records, but they seem at this time to have been carried away, either by the example of the Egyptians or the traditions of the ark in the construction of a vessel which was afterwards sent on a voyage to Egypt, and presented by Hiero to Ptolemy Philopater, and which is said to have surpassed in fittings and ornaments even those built by himself. It is said that its timbers would have made sixty triremes. Besides baths and rooms for pleasures of all kinds, it had a library and astronomical instruments, not only for navigation as in modern ships, but for study, as in an observatory. It was a ship of war, and had eight towers, from each of which stones were to be thrown at the enemy by six men. Its machines, like modern cannon, could throw stones of three hundred pounds weight, and arrows of eighteen feet in length. It had four anchors of wood and eight of iron. It was called the ship of Syracuse; but after it had been given to Philopater it was known by the name of the ship of Alexandria. I have given you these particulars, thinking they may be interesting, although outside the subject of the lecture.

The point which I wish to bring to your notice in connection with Archimedes, the man who discovered the first law of flotation, and which is supposed to have been discovered in connection with the king's crown is, that his mind must have been powerfully devoted to such questions by being associated, as it was in the construction of large ships. There is nothing to show, however, that his discovery was influenced by his connection in this respect with shipping, or that he even applied it to the flotation of a ship, although the probabilities are that he did.

The first trace we have of the law which states that the weight of a ship afloat is equal to the weight of water the ship displaces, being practically applied to shipbuilding in England, was in the time of the Stuarts, and is recorded in Pepy's diary in the following curious paragraph:—"Mr. Deane (afterwards Sir Anthony Deane) and I did discourse about his ship the *Rupert*, which succeeds so well, as he has got great honour by it, and I some by recommending him. The King, Duke, and everybody say it is the best ship that was ever built. And then he fell to explain to me his manner of casting the draught of water which a ship will draw beforehand, which is a secret, the king and all admire in him; and he is the first that hath come to any certainty beforehand of foretelling the draught of water of a ship before she is launched." It is true errors are sometimes made even in the present day in the calculation of what draught of water a ship will float in, but this throws no discredit whatever upon the law which is abundantly proved and demonstrable. The only point where errors can arise is either in the calculation of what amount of water a ship will displace at a certain draught of water, or in the calculation of what weights are actually to go in to complete the structure of the ship and fittings, and other weights on board of her. The former is a much simpler and shorter calculation than the latter, and is usually about correct. The error, whenever it does arise, is almost certain to be in the latter, which you will easily understand is a laborious affair, and is always more or less a source of anxiety to a shipbuilder.

However, assuming that the calculations in this respect are correct, the next point which arises is, whether the ship when floating at this given draught of water is capable of remaining upright, and if sent to sea, whether she is capable of keeping upright, or rather, of not capsizing when tossed about, as she is bound to be, among waves. Here enters the question which is one of much more recent investigation than the question of buoyancy; and the first real step in this direction which has become historical was made by a Frenchman named Bouguer, about 130 years ago, when he investigated and gave a name to the point since become so well known among naval architects as the Metacentre. His investigations were in a great measure confined to ships in an upright condition, or within the range of modern angles of inclination; and it was some 70 years later before the theory of stability of floating bodies was discussed on a really broad and comprehensive basis from a geometrical point of view by Dupin, another French writer. English writers, until a much more recent date, did comparatively nothing to advance the science of naval architecture. Indeed, it is a source of humiliation, and realised by all naval architects, that throughout the last century, and the early part of the present one all the great advances made in the science of naval architecture, were done in foreign countries; and the student who wishes to acquaint himself at first hand with the history of that period, has to search the works of distinguished Frenchmen like Bouguer, Dupin, Euler, D'Alembert, the Abbe Bossut, the distinguished Spaniard Don Juan, and Chapman, the celebrated chief constructor of the Swedish navy. On all questions of flotation and stability in still water, they had advanced as far, or nearly as far, as we have at the present time. Their investigations in reference to the rolling of a ship among waves, although learned and elaborate, have since been proved to be in the main erroneous. This latter subject, though largely discoursed upon during the present century, at home and abroad, was really in a state of chaos until down to so late as 1861, when the late Mr. Froude, of Torquay, after much careful thought and investigation, and experiment, enunciated at the Institution of Naval Architects, an entirely new, striking, and at the first flush incredible theory, which has since been absolutely proved to be the sound one. I know that it would be out of place in a lecture like this to enter into technicalities, and I will therefore only give you a few brief words on the fundamental difference between the views prevailing up to that time, and those which are now the accepted ones. Previous to Mr. Froude's paper the action of waves upon a ship was considered in the light of so many blows on the side of the vessel to windward, tending to throw her over in the opposite direction. The water was considered to be acting on the ship, like so many masses thrown at her side, and this is to a certain extent true in the case of a large ship floating among small waves. Mr. Froude started from an entirely different point of view—that of a small ship floating among very large waves, in which case, as you will easily see, the ship is carried bodily round over the waves, and nothing in the shape of a blow takes place. The action is then like that of a body in a swing. What then became the nature of the influence which arose between the ship and the water? In the first place the actual movement of the water had to be arrived at, and Mr. Froude, who had thoroughly grasped the subject, assumed what is now known as the Trochoidal Theory of motion, but which he was not able absolutely to prove until the following year, when he did so at the Institution of Naval Architects, simultaneously with Professor Rankine's proof of the same thing before the Royal Society. I will here give you an illustration of this; and before doing so I may mention that I scarcely expect you will believe it immediately. I say this in no uncomplimentary spirit to you, but as based upon my own experience. And I may also mention a curious fact in illustration of this. It is known to one or two in the room, who were present, that not long ago on board a rather famous ship, which most of you know, we were at sea, and after a trial trip a number of people were assembled in one of the cabins, discussing the behaviour of ships under different circumstances, [and I may say that all those present were people who spoke with a certain amount of confidence and experience on the subject. Some had been to sea for years], when on being appealed to I mentioned and illustrated one elementary fact, which lies at the root of the whole question of rolling among waves, when to my great amusement I found that one and all were thinking I was playing a joke upon them, and trying it on too far. However, when they found that my amusement was even greater than theirs they kept pegging away at the matter, and I think at least a few had become converts before we got on shore. I am sorry I have not a model or a black board to explain the matter, but will endeavour to get you a simple working model which will soon convince you. It is this—that if you take a raft and fix up a small pendulum or plumb bob on it, say over the centre, and then put that raft afloat among waves (I mean long rolling waves, not broken water) the bob would continue to hang over the centre. It would not hang vertical at all except when the raft was on the crest or hollow, but would on the slopes hang in square towards the surface of the water. Or to put it another way; if there was a round marble on the raft, it would have no more tendency to roll down hill towards the hollow of the wave when the raft was inclined on the slope than it would have to roll uphill towards the crest. But this is another digression, and I must get back to the point I was aiming at. Experiments out of number have been made in confirmation of this theory on board Her Majesty's ships, on board ships of the French Navy, and in some cases on board of merchant ships, and there can be no doubt that the lessons derived from them have tended in a great degree to modify the designs of vessels, and to lead to their better behaviour at sea. Further investigations in reference to the question of stability have arisen out of terrible disasters, such as those of the *Captain*, *Eurydice*, *Atalanta*, and a number of merchant ships, all tending to increase our knowledge of the conditions under which a ship should proceed to sea, free from the horrible danger of capsizing, either under steam or sail. If the danger has not been entirely averted—and we have only too great reason to believe it has not—by recent disasters that have occurred, such as that of the great screw-steamer *Austral*, recently capsized in Sydney Harbour, and some other merchant ships recently capsized at sea, the danger is not owing to the want of accurate knowledge of the subject, or of well-defined rules for carrying them out, but to the fact that those rules are either ignored or carelessly or incorrectly applied.

Leaving the question of stability I will next touch upon the question of Speed, a far more difficult and intricate subject, and on which up to the present, knowledge is less precise and defined. Heaps of experiments have been made at different times and by different persons; and heaps of rules have been formulated thereon. But it is well within the mark to say that our ancestors, or rather our predecessors in the profession, even including the celebrated foreign names I have already mentioned, were hopelessly adrift, and that until within the last 20 years the elements of the problem were not fairly comprehended. We know the analogies that have been drawn between the forms of ships and the forms of various fishes celebrated for speed, and at one time the theory of the cod's head and mackerel tail became almost a proverb, as the correct form for ships. Again experiments were made with blocks of wood with wedge-shape entrances for the purpose of ascertaining what angle of entrance was best for certain speeds, but all this led to little or nothing. Sir Isaac Newton investigated mathematically the form of least resistance, and found it to be a parabolic form, and this has been perpetuated down in books on hydro-dynamics even to the present day. But for purposes of naval architecture it was equally misleading. A really tangible start was made by the late Mr. Scott Russell many years ago, from his observations of the waves when canal boats were drawn at comparatively high speeds, and upon it he based his celebrated wave-line principle of construction, and he followed it up in practice. It is perhaps not unfair to assume that most people thought there was a good deal in the principles enunciated by Mr. Scott Russell, and copied them when designing ships, although they did not allow the principle to fetter them to any large extent in the form of their models. And no doubt there was a good deal in it, but the deductions derived were not exactly those drawn by Mr. Scott Russell, of whom it is no discredit to say he did not fully realise the scientific aspect of the case. Professor Rankine soon afterwards made a considerable advance in our knowledge by his writing on what is now termed the Stream-line Theory, and it was again reserved for Mr. Froude to get at the root of the matter. It would be useless here to attempt to enumerate even the various investigations of Froude and Rankine on this subject, or even to sketch the various steps by which Mr. Froude advanced by painstaking research and beautifully contrived model experiments, from point to point, until he had got the matter well within his grasp. He it was who first discovered the law by which, with any pretence of accuracy, experiments with models could be made to afford valuable data for the resistances of full-sized ships. He it was who first brought it home to the ordinary comprehension, why ships and models floating on the surface, or partially immersed in water, appeared so difficult to drive at high speeds, while fish with little apparent muscular exertion or disturbance in the water could go at speeds almost incredible. Few men of science in our present day have enunciated such apparently startling propositions as Mr. Froude, and made them so abundantly clear, that they were almost immediately accepted as laws. Mr. Froude showed that a body of any form, deeply immersed in a boundless fluid with no friction, could move uniformly, if once set going, without any further addition of force, and that when it came to a medium like water, which has some friction, friction was the only thing which caused resistance. This explained at once how fish with smooth slippery coats were able to move with apparent ease, with little expenditure of energy. Coming from a totally submerged body, to one partly in and partly out of the water, the case he showed became entirely different. The friction on the immersed portion of course remained, but the waves raised on the surface of the water were shewn to carry away much of the energy devoted to propulsion, and prevented that closing in of the water so firmly on the stern of the ship as to give back the pressures exerted by the fore-body: and the study of these waves, hence, has become a matter of very much greater moment than it was formerly considered to be.

To press this matter more closely home, I would ask any of you who have watched the beautiful effect produced by wave disturbances, say round one of the steamers on lake Windermere, when the surface of the lake is calm as a mirror—to imagine for a moment what the effect would be if you could surround the vessel closely by a large sheet of glass just level with the water, and moving with the ship in such a way that those waves would not rise. It would be that the pressure on the water produced at the bow would be transmitted to water astern, and would close in with greater pressure round the stern, and give back to the vessel that energy which is now expended in producing wave motions; and, as a consequence, the vessel would travel much faster through the water with the same degree of horse power. Of course, this is an impracticable thing to carry out, and I only use it for the purpose of illustration.

Closely allied with this question of resistance is the question of forms and sizes of the screw propellers, which is still in a very unsatisfactory state from a scientific point of view; and people have to proceed very carefully and tentatively from ship to ship guided as they can be by experience.

One other feature of ship-construction I will allude to, and that is, the question of Strength. Here we have passed through many phases, and taken enormous strides during the present century. The mere change from wood to iron was in itself a revolution of the most thorough-going kind; and again the changes in iron ships from 100, 200, and 300, up to 400, 500, and 600 feet in length, have required most careful watching. Errors have been made, of course, as might have been expected; but the marvel is that they have been so few, and that so little in the way of disaster to human life has resulted therefrom.

The very rapidity of the changes that have taken place strengthens our cause for congratulation. In my own case I, have been employed in the construction of what are now known as obsolete wooden frigates and line-of-battle ships, and worked as a youth on the old *Howe*, the last of the 120-ton three-deckers. I witnessed the change in the Government Dockyards from these vessels to the armour-plated wooden vessels to the *Prince Consort* type; and from that again to the iron armour-plated ships of the Navy.

We have all seen the wonderful growth in the size of iron merchant steamers, and we are now witnessing another change from iron to steel, which is slowly but surely taking place. In times like these, with changes so vast taking place in a single generation, it is simply impossible to think of being content to follow blindly the dictates of practice from one ship to another. And corresponding and equally important changes have been going on in the marine engine, where the pressure of steam has gradually risen from 20lb. to 30lb., to 125lb., and even 150lb.; and where the consumption of the fuel per indicated horse power has been reduced from about 4lb., with a jet condensing engine, to a sea consumption of 1¾lb. with the best type of compound engines. And even this promises to be still further reduced by using triple expansion compound engines.

I have given you this brief but imperfect sketch to show you that there is much in naval architecture worth study—in fact, enough to fire the mind of any young man to a determination to work hard during his younger days, when he has plenty of time and leisure on his hands, to grasp the salient points, and make him understand thoroughly the profession to which he is about to devote his life.

I will next endeavour to trace out some of the steps that have been taken in this country to provide the means for supplying a very sound training in naval architecture. And here it must be admitted at once that the efforts have been, until a comparatively recent period, confined to the Royal Dockyards. The Government service is to some extent curiously constituted in this respect. They aim, and have aimed for years, at training all their own men from youth upwards, and it is the greatest exception in the world for a man in middle life to obtain any high position at once in the Government service. The consequence is, the need has always been felt, more or less, to provide educational means within the dockyards themselves; and although we never hear it mentioned in speeches on technical education, yet it is a simple fact that the Government have for years spent large sums of money on this one single object of giving technical education, and in the highest sense of the term to those employed in the Royal Dockyards; and even in the form of compulsory education. Under Conservative as well as Liberal Governments apprentices have been invariably compelled to attend school at certain intervals, part of which were within the ordinary working hours, and part in the form of evening classes. Over and above this the Government have on three successive occasions instituted central schools of naval architecture, for the purpose of providing those most distinguished in the local dockyard schools to undergo a still higher course of instruction. The first of these was established at Portsmouth in 1810 and lasted for 23 years. The second was again established at Portsmouth in 1844, after the want had again been keenly felt, and lasted till 1853. The third was established in London in 1864, after pressure had been brought upon the Government of the day by the Institution of Naval Architects. It was placed for the time being under the auspices of the Science and Art Department at South Kensington, and has since been merged into the still greater establishment of the Royal Naval College at Greenwich, where it is still in existence. Students in naval architecture and in marine engineering are selected from the several dockyards every year, and go to the college for a course of three years, the winter months of which are devoted, under able professors, to the study of mathematics, physics, chemistry, ship design, and calculations; and the summer months are devoted to practical work in the dockyards.

Now, it is a question which has always been rising in my mind, and in the mind of many others, as to how an institution of this kind can be made useful to the mercantile marine, without impairing its efficiency as a Government establishment. Nominally, it is open at the present time to any student upon payment of certain fees, and provided he can pass a certain preliminary examination. I have these regulations here, but it would tire you if I were to read them. I will leave them in the library for any one sufficiently interested to inquire for them. The fee, I may mention, is £30 for each year, or £75 for the full course, and of course the student would have to live in lodgings during the time and support himself. This, you will say, at once puts the matter out of the reach of the sons of working men; but it is not quite so, for the Admiralty have very wisely made a condition that any applicants passing up to a certain standard in the examination will be received into the college as free students; and there is a further competition, open to all comers, for two scholarships of £50 a year: one presented by the Admiralty, and the other by the Committee of Lloyd's Registry, both being tenable for three years. Now, the remarkable part to my mind is that these scholarships have been absolutely open for several years, and although they are capable of supporting six students at a time, at £50 a year each, and giving them the highest training in naval architecture or marine engineering—whichever line they may choose for themselves—(the Admiralty grant being £150 a year, and Lloyd's £150) yet there has been scarcely a single competitor presented himself. When one looks round to seek for the cause of this, it is only to be found, to my mind, in defective local organisations to train young men up to a sufficient standard to enable them to take such a strong interest in their profession that they will sacrifice their time, and make a determined effort in their spare hours of an evening to qualify themselves to pass these examinations and obtain scholarships.

This brings me to another step in an organisation already prepared, and only requiring to be properly utilised to supply all our requirements. I allude now to the Science and Art classes established throughout the country, promoted, largely encouraged, and to some extent subsidised, by the Science and Art Department at South Kensington. Such classes are already in existence in Barrow, in the Abbey Road, for the promotion of study in some branches of learning, but have not yet extended their influence to naval architecture. I have reason to know that the promoters of the present classes would welcome their extension in the direction which would be most welcome to us. Such professional classes, when combined with mathematical and other classes, should be such as to bring the training of persevering and talented young men up to the standard necessary to secure the £50 a year competitive scholarships now going begging at the Royal Naval College. And where success is achieved a little local aid should be forthcoming (and I do not doubt that it would where necessary) to supplement this, and enable young men who would be a real credit to the town to maintain themselves fitly during their three years of laborious study. This is no visionary scheme. Such classes do at the present time exist in Dumbarton, Newcastle, and many other towns, and they are producing marked results. But the results up to the present are nothing compared to what they will arrive at when the teaching becomes more systematic, and emulation between the students increases. Local aid has not yet taken a practical shape, so far as I am aware; but I know it has been in contemplation, at least in Dumbarton, where Mr. Peter Denny, his son, Mr. William Denny, and all the members of their firm, are heart and soul in the work of promoting the intellectual development of their native town. And so, when this matter is taken hold of firmly and manfully in any shipbuilding centre, most assuredly will that locality produce a race of naval architects which will largely absorb the leading positions in the profession in the next generation, and reflect the highest form of credit and prestige on the place in return. And it will be no mean return either.

The following are some particulars of what has already been done. According to the Report of the Department last year, there were no less than 280 students attending the Naval Architecture Classes. In Dumbarton alone there were by the last data twenty pupils, and the class had succeeded in obtaining four medals for naval architecture, including one gold medal, the only one that has yet reached Scotland.

And now I have taken up so much of your time that I must bring this lecture to a close. I have done little more than skim over the surface of the higher branches of naval architecture. The whole routine daily duties of a shipyard I have left untouched. There is a vast amount for all young men entering the profession to learn in them, in the ordering of material, arranging plans, and carrying them out in detail. All these are of the utmost importance. In fact, they are absolutely necessary for the every-day life of the yard, and must, and will, always receive their due share of attention. And for this reason only, not in the least degree undervaluing their importance, have I not dwelt upon them.

There is only one other point I will touch upon, and that only because it involves a difference in the conditions under which a young man enters upon a career of shipbuilding in the present day, and the conditions prevailing in earlier times, such as the days of wood shipbuilding. The present division of labour, to some extent, precludes his passing through all the branches of the trade. The trade itself has also changed materially. The very odour of chip-shavings, Stockholm tar, and oakum which pervaded the old wooden ships is gone for ever. The men who laid off and moulded the elaborate head rails, counter timbers, quarter-galleries, and all the complications of the old days have lost their occupation. But there is still enough left in shipbuilding to render it one of the most interesting occupations in existence; and as such I hope it will always be regarded by the inhabitants of Barrow, whose prosperity is inseparably bound up with it beyond recall.

ON THE TRIPLE EXPANSIVE ENGINES OF S.S ABERDEEN, AND THE ECONOMY OF COMPOUND ENGINES*

By A. C. Kirk & W. Parker.

DISCUSSION ON THE PAPERS.

MR. REYNOLDS: I would just like at the same time to raise the question whether people could afford this kind of economy in working down to this one pound of coal. I approach the subject with some diffidence, because I never heard two papers read which were less dogmatic, or which put their views so fairly before us. As far as they go they are convincing that if we want to get a higher rate of expansion than we have had, we must do it by keeping down the temperature in each cylinder; but the question is, what is the result worth? I am first of all reminded of a circular which I got respecting a triple expansive engine during last week. It is one in which the initial pressure is still greater, and they give in this circular two or three diagrams superimposed one upon the other in the usual way. The first, I suppose, was an actual diagram, and also the second; the third was a calculated diagram. I suppose the pressure was too great, and they made it out to be equal to the sum of the other two diagrams put together, and in that way a low consumption of fuel per horse power per hour was got. I will not here mention names, but I dare say you will guess; it was a boat which made a celebrated voyage, and during the whole time of that voyage it seems to have averaged 4½ knots. That is the general kind of result, as far as I know, of these very high degrees of economy. Of course I do not argue that triple expansion may not, and probably will, get a stage further. But I was reminded this morning of a report in the *Times* in the middle of last year of some trials of the *Nelson*. At first I know I was considered a Philistine by some of my friends because I said that they did not prove economy for that high ratio of expansion. The work done clearly in the same ship, under the same circumstancess, will be, at those low velocities, somewhere about in proportion to the cube of the ship; cubing the lowest speed, and dividing that by the total coal we get 9.03 lb. of coal per hour for each unit of the cube speed. Then taking the 10 knots speed, when the consumption had risen to 1.9 lb. of coal per horse power, the total coal then divided by the speed cube is only 4.885 lb. of coal per unit of cube speed. That is to say, the ship was doing nearly double the amount of work per ton of coal when the nominal consumption was 1.9 lb. of coal per horse power than it was when it was burning 1.7 lb. of coal per horse power. Then to come to the last result. When they were going at a maximum speed of 13.33 knots, and burning 2.2 lb. of coal per hour, the consumption of coal per unit of cube speed had risen to 5.77. That is to say, we had passed the limit of maximum economy a little, but still the result was 50 per cent. better than when the same engines were working under the other conditions.

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* Read at the Twenty-third Session of the Institution of Naval Architects

Mr. Joy: Would you allow me to say a word on an experiment which was tried very much in this direction six or seven years ago by a Barrow shipbuilding company, and at which Mr. Parker was present? no doubt he will remember it. That was a ship built with boilers to carry about 120 lb. of steam, and engines to match. It was at a time when consumptions were about 2.2, or perhaps a little less. That ship had only two cylinders, high and low pressure, and I was a little surprised to find the consumption came down only to 1.67. Now, in those experiments of Mr. Kirk with the *Aberdeen*, showing the same pressure it came down to 1.3, that would appear to me to prove that probably what we lost, or did not gain, was owing to our too rapid expansion, expanding only in the two cylinders. I have the indicator diagrams and all the particulars taken at the time, and they are at Mr. Parker's service if he likes to compare them with these, so as to show him how a larger consumption, although with the same expansion as in this case, may have been accounted for by the greater condensation in the cylinders.

Mr. A. C. Kirk: My lord and gentlemen. This paper that I have had the honour of reading, I am glad to say has been subjected to a very full and very fair criticism. Mr. Longridge was the first to criticise the paper, and I will say generally, I think he took the ground that expansion of steam was expansion of steam do it as you like, do it in one cylinder, or do it in a dozen cylinders. So it ought to be, but in this world things are not quite as we think they ought to be, and though no doubt Mr. Longridge has a good many interesting experiments to refer to, the whole mercantile marine of this country has been one big experiment on this subject for the last twelve years, and the result is it has proved that two cylinders have worked more economically than one. I will not go further than simply to adduce that fact, which conclusively settles that question. He then refers to superheating as giving a greater economy. Of course it does, because by it you get the high temperature, and that is what you want. If we could get the temperature of steam without so rapid an increase of pressure we should be very glad, but unfortunately the pressure keeps rising very much faster than the temperature. Now, he seemed to think that the difficulty was in making a superheater. There is no difficulty whatever in making a superheater; I have superheated steam so that it would set a piece of wood on fire when it was blown on, but the difficulty is to produce an engine to work with highly superheated steam. Although I am prepared to take in hand an experiment about as freely as most people, I am certainly not prepared to advise any of my friends, as a commercial matter, to put money in work with which I have to do, of the pure and simple experiment type, and which may be just as likely to fail as not, and perhaps more likely. We know that with highly superheated steam you cannot lubricate the surfaces and that they wear excessively. The only approach to lubrication that is practicable is by keeping the cylinders as cold as possible, and then you can condense a little steam on their inner surfaces, but then the goodness of the superheating has to a great extent been lost. Now when I come to Mr. Cowper's remarks, I feel some diffidence. Mr. Cowper is an old authority on this subject, and to Mr. Cowper is largely due, at all events, practically due, the introduction of the present receiver type of compound engine. Therefore, as I say, I speak with some diffidence. When Mr. Cowper takes the indicator diagram there, and the whole expansion is supposed to be properly performed, no doubt he is quite right when he says 12 per cent. or so is about all you can gain. But while this is true, it is largely modified in practice by the way in which it is carried out, and this is the point which formed the subject of the paper. Steam jackets were for a long time considered to be the panacea of all evils. Certainly steam jackets do this much if the engine go slow enough, and give the heat time to be conducted from the outside of the barrel to the inside of it. The steam jacket will keep the inside of the cylinder at the temperature of the admitted steam; there will be no steam condensed, and if no water comes into the cylinder, the only steam evaporated towards the end of the stroke will be the steam condensed in doing work. However, I will come to that point by-and-by. But then it is not always that we get steam free of water. My friend, Mr. Macfarlane Gray, says that the steam we have is water suspended in perfect gas, but we even get a little beyond that, and get in ordinary steam a good deal of actual unquestionable water suspended in it, and when we get to that length the effect of the steam jacket is to make the cylinder a steam boiler. Now, there is not much harm happens, say, in a high-pressure cylinder by this evaporation of water, but when you get down towards the end of the expansion of the steam, and you begin there to evaporate any tangible quantity of water, I cannot at all see what good you have got by it. You certainly would better have got that water straight out of your cylinder than have gone and spent that heat direct from your boiler—the heat of the high-pressure steam to generate a certain quantity of very low-pressure steam that has only a very little work left for it to do. I cannot see that when the jacket begins to have that function it is doing right, and when you get to long ranges of expansion, it is hard to see how the jackets can help doing it. There is another method besides the steam jackets of preventing the large variations of temperature (in which there is no harm in itself), and along with that the large condensation and re-evaporation that can take place, and that is to divide the expansion into steps, and keep the change of temperature in any one cylinder comparatively small. You might conceive the steps so numerous and the range of temperature in each so small that jackets would be quite useless. I think in practice in the ordinary marine engine we are now in this position, that jackets are not of very much use. I do not think it is very necessary to dispense with them; they are convenient at all events to heat up the engine, and though very little economy may be gained at sea by them, if they are carefully worked, at the best it is not much, and we know that the receiver type of engine (apart from the Wolf engine), got a great start from not depending materially on the efficient use of steam jackets whereas the Wolf engine did. In Mr. Elder's Wolf engine, for such his compound engine was, for instance in the four-cylinder engines of his paddle-boats, the steam in the high-pressure cylinder after working through the range of expansion to the end of the high-pressure stroke, expanded simultaneously in the high and low-pressure cylinders, and the high-pressure cylinder was reduced to the temperature of the release of the steam to the condenser. Thus the high-pressure cylinder passed through the full range of temperature possible excepting the drop from the temperature of release to that of the condenser. So the practical effect on these paddle engines if the jackets were neglected in the very least degree was to produce such a cracking noise from water, in the bottom of the cylinder particularly, as would rather frighten you. I confess at first with the first pair I had through my hands, I did not see the cause, and got a bit of a scare, but one of the old hands said, "Let me open the jacket drain cock at the bottom." He did so, and it was all right. What I have said comes to this, that I do not quite sympathise with what Mr. Cowper has colloquially called his hot pot. I confess if he could heat it with waste heat, good, but if he take the heat out of the boiler to heat it there, I do not quite see the advantage of it. I do not think it is necessary for me to refer to Mr. Macfarlane Gray's remarks. We shall have his paper no doubt, and I dare say more fully developed. I can only thank you for the patience you have had.

Mr. W. Parker: At this late hour, my lord, I will content myself with only a few remarks. I listened with great interest to what fell from Mr. Longridge, whose opinion arrived at in the full light of his recent researches into the performance of land engines is of much value, but it is contrary to the experience of all marine engineers. I should like to draw attention to the fact that measuring the efficiency of a land engine is one thing, and measuring the efficiency of a marine engine quite another thing. In a land engine you can accurately ascertain the work performed and the amount of water used in generating the steam, so that the efficiency can be easily determined, while in a marine engine the conditions are very different. In the first place, marine engines are so powerful as compared with those on land, that it would require a very large and complicated appliance to measure the amount of feed water used; and secondly, even if this were made, it would be almost, if not quite, impossible to maintain precisely similar conditions as regards weather, &c., in different trials, so that we can never hope to have such accurate data for marine engines as that obtained from land engines by Mr. Longridge. Mr. Longridge's opinion that we should expand our steam in one cylinder only was shared by many of our eminent marine engineers years ago, and I may give you one instance out of several where the idea had a fair trial and failed. Many of you will doubtless remember that in the year 1872 the Allan Line went to the expense of fitting their steamer *Circassian* with a pair of engines of about 2500 indicated horse power to work at a pressure of 60 lb. per square inch, having an early cut-off, and expanding the steam in one cylinder only. These engines worked for a few voyages in the Atlantic trade, and it was found that the shock at the commencement of the stroke, and the consequent vibration of the vessel, were so great as to render it impossible, if not even dangerous, to drive the engines at full speed, while the consumption was found to be greater than with engines of the same power expanding two cylinders. So far convinced was Mr. Wallace, the company's superintending engineer, of the unsuitability of these engines that he advised the company to replace them with ordinary compound engines, which were accordingly fitted. This is only one of several cases where it has been proved that expanding steam in a single cylinder in a marine engine is not the most economical arrangement for the propulsion of a steamship. With regard to Mr. Cowper's remarks about jacketting, I may say that our experience in the *Aberdeen* amounted to this, both the middle and low-pressure cylinders are jacketted with steam from the boilers, and the engines were worked for three or four hours with the steam in the jackets, the drain water being gathered in two tanks so as to enable us to ascertain the weight of steam used in the jacket, and indicator diagrams being taken at intervals of about a quarter of an hour; the engines were then worked for a few hours with the jackets free from steam, indicator cards being again taken at short intervals, and on comparing the results we found that if about the same weight of steam that was used in the jackets were utilised in the cylinders, we should get practically the same results. Mr. Scott asked about the curves exhibited on Fig. 2. Well, the indicator diagrams shown on that figure are taken from a two-cylinder compound engine constructed to work at a pressure of 125 lb. per square inch, the same pressure as is used in the three cylinder or triple expansion engine shown on Fig. 1; and it will be observed that in the horse power card there is a considerable space between the curve shown by the diagram and the adiabatic curve, or curve of the perfect engine, the cause being undoubtedly the large amount of initial condensation taking place in that cylinder. Mr. Joy made a remark about the steamer *Howard*, built by the Barrow Shipbuilding Company. She had an engine very similar to that represented in Fig. 2, and her engines worked at the same pressure, but the ratio of cylinders was very different in the two cases, very little expansion taking place in the horse power cylinder of the *Howard*. In this paper I have carefully avoided saying anything about consumption of fuel in relation to indicated horse power, and have merely tried to show the loss that must take place in an engine working at high pressures, and with long ranges of temperature, from condensation only, but the actual efficiency in any one engine depends very largely upon the details of the slides and ports, so that in considering the efficiency of any type of engine it is not sufficient to draw comparisons between it and an engine of different type unless the arrangements alluded to are equally well designed in each case.

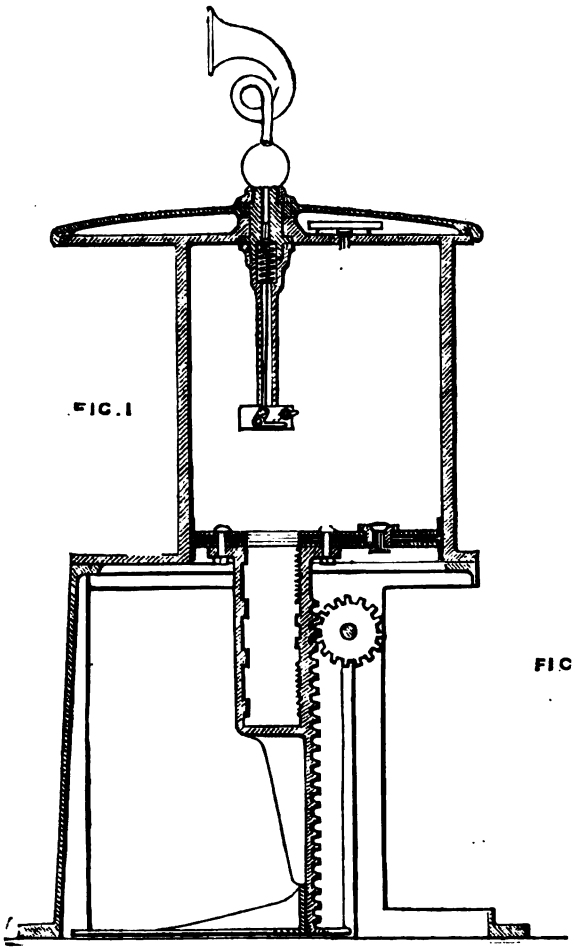


FIG. 1

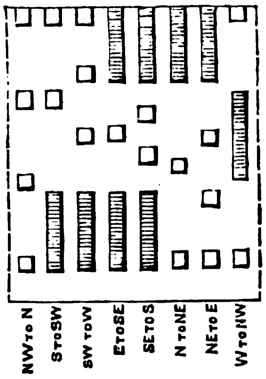


FIG. 3

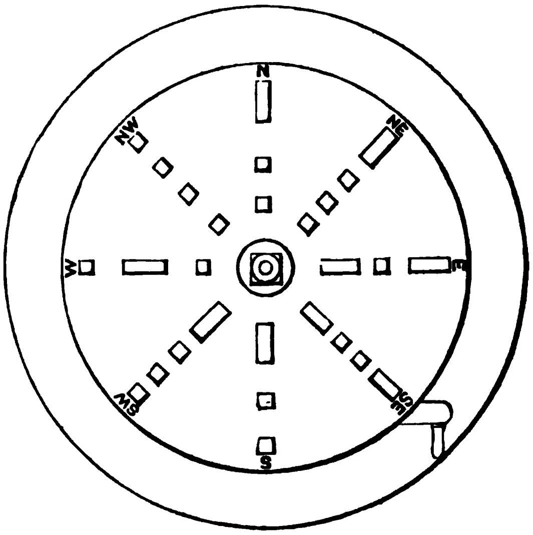


FIG. 2

BARKER'S MARINE SAFETY SIGNAL AND CODE.

BARKER'S MARINE SAFETY SIGNAL AND CODE.

THIS invention is designed to signal the approximate course steered in fog, by a system of well arranged long and short sounds or blasts given by compressed air, using the fog-horn for sailing vessels, and is so constructed that by placing the instrument on the deck of steam driven vessels, it will as readily work the steam whistle, siren, or any other steam sound producing instrument, by disconnecting the fog-horn and allowing the compressed air to escape while the steamer's course is being signalled. The code used on each vessel being the same, a marked distinction being made between the signal given by the sailing vessel, and that given by the steamer. This is of the utmost importance to the interests of navigation, the sailing vessel having right of way in all cases when in the vicinity of steam vessels, should define at once the character of the vessel making the signal for the guidance of the steamer who must pass clear.

A brief description of the mechanism for sounding the approximate course steered, using eight signals representing the thirty-two points of the compass *four*, for the Eastern, and *four* for the Western hemisphere is here given.

A dial, or compass plate supported over a cylinder and marked to represent the (8) eight principal points of the compass is so arranged that by turning it until the course steered corresponds with the course marked on the dial plate, both being in range with the vessel's bow, a signal indicating that course will be given, *and no other*, for this reason. To the dial plate is made fast a tube or pipe, at the lower end of which is a valve and lever attached, which comes in contact with a different number and order of iron cams. As the plunger rises to compress the air, a signal box supported by the plunger carries the cams representing the signals marked on the dial plate, therefore if the dial plate corresponds with the compass course steered, the lever operating the valve must be in range with the proper number and order of cams.

A series of gear wheels, one of which is a ratchet wheel, work the rack, made rigid to the signal box and plunger; the driving wheel may be turned by *hand* or by *steam*, and when driving the series of gear wheels causes the plunger to rise and compress the air in the cylinder. At this point, the cams in the signal box, in range with the lever, operate the valve and cause the compressed air to escape through the tube, giving long and short sounds from the horn.

When the entire signal has been given, the ratchet wheel causes the plunger to drop, and, by a drop valve in the plunger, the interval between signals may be regulated to sound a blast once in ten seconds, or in two minutes, and can readily be adjusted in a few seconds. When once set to work, uniformity in signalling the course steered is attained.

On a steamer the horn is removed from the machine, a wire or rod being attached connecting it with the lever of the steam whistle or siren, causing a signal to be given clearly and distinctly, the compressed air escaping through a valve designed for the purpose.

One feature in this mechanism is, should the steamer in a disabled condition be surrounded by fog, such as we have reason to believe the *Quebec* was, and being unable to clear any vessel, by rule of the road, she might easily detach the wire or rod, and sound the course steered on a fog-horn, alternately giving a signal of distress, thereby claiming right of way over all vessels.

The necessity for something of this kind to protect the interest of the ship owner, and the lives of those who sail the vessel, cannot for one moment be disputed, the simpler the mechanism, the less liable to derangement at sea, and the more readily will it be used and understood.

The only machine in Europe to-day, which is worked on the above principle, is to be seen at the Royal United Service Institution, Whitehall. This instrument has been in almost constant operation since the year 1879, and is so perfect in its construction, that instead of having suffered any deterioration in its action, is really more perfect than when first exhibited.

The machine referred to is the experimental machine, and shows the principle on which such machines should be constructed.

The great advantage attendant upon the use of this instrument is the utter impossibility of a wrong signal being given, nothing more being required than the adjustment of the dial plate to the compass course steered.

It will thus be seen that in the *choice* and *arrangment* of signals, nothing whatever is left to the discretion of the officer working the apparatus, who in the time of threatened danger from approaching vessels, might, in his anxiety and excitement, fail to give the proper number and order of sounds.

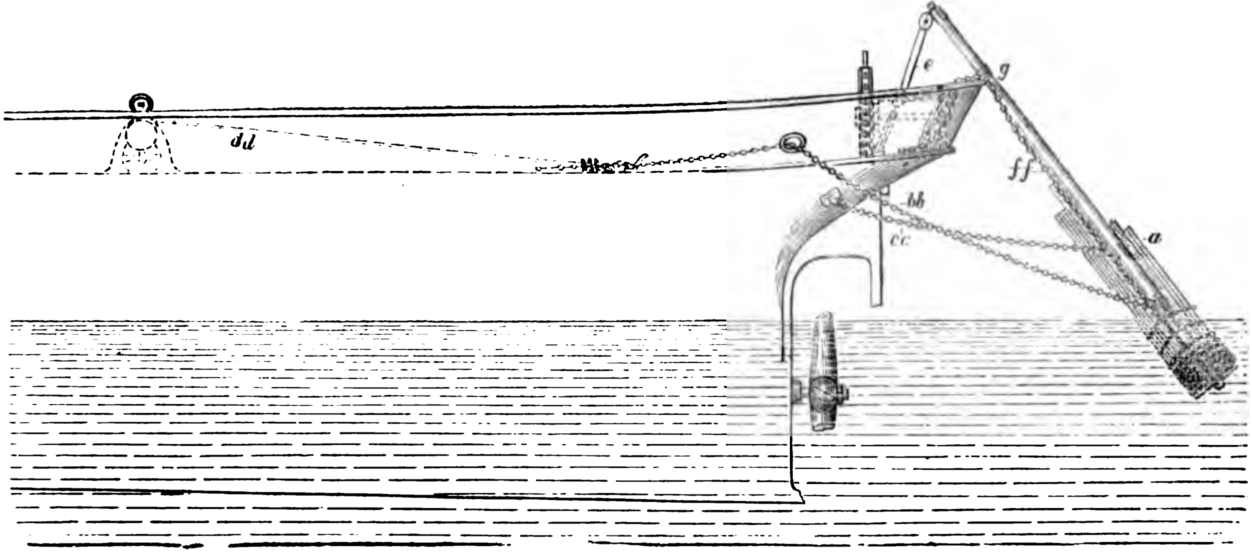
All nations are capable of distinguishing the difference between long and short blasts, the language of the code is therefore purely international, a characteristic universally admitted to be not only a desideratum but an actual *sine qua non*.

The object of this instrument being the saving of *life* and property, its *cost* should be no hindrance to its adoption, although it should be constructed at the lowest rate consistent with good material and workmanship.

The recent terrible disasters at sea, in which so many lives have been lost, a great number of which might have been saved by the possession of an efficient method of signalling, call imperatively for the immediate adoption of some such instrument as the above.

CAPTAIN WAKE'S JURY RUDDER.

ALL of our readers are aware that the rudder of a ship, although of exceedingly small dimensions, plays a most important part in governing the behaviour and shaping the course of every class of vessel. When it is desirable to convey the idea that a scheme, company, or individual is being conducted or is acting in a manner which must terminate eventually in irreparable loss or damage, it is a very common thing to say that *they are like a ship without a rudder*, as fully conveying the idea of the worst possible condition to be in. This idea is fully borne out when we consider the helpless state to which a ship is reduced by the disablement or loss of her rudder at sea. Some old salts would tell us that in the days when sailors were sailors, and ships were ships, many an old captain and shipmaster has steered his vessel by trimming and balancing the moment of effort of the sails, without thinking of shipping a jury rudder. This we know has been done, and no doubt many of the seamen of the present day could handle some of our fine sailing ships in quite as able a manner; but since the introduction and development of steam propulsion the navigator is more dependent on the rudder than in times gone by, as the sail power in steamships is reduced to a minimum. Not only this, the form and build required for general handiness is often completely sacrificed to the shape which will allow for the stowage of the greatest amount of cargo. Thus the distribution and effort of numerous sails, the clean run of the after body, the fine entrance forward, the cutting away of the fore foot, and the rise of floor, which was so much studied when seaworthiness and handiness were considered equally as important as cargo-carrying capacity, has been completely changed, so that we now have long deep vessels, with perpendicular stems, a very slight rise of floor, a sharp turn of bilge, and a sudden shaping forward and aft to bring the lines in to the stem and sternpost. These cargo-carrying machines are loaded so deep that it is doubtful if, in the event of their rudder being carried away, they could be managed, if fitted with any amount of sail; and when, as at present, they are only supplied with pole masts and a most insufficient sail area, the efficiency of the rudder, or the prompt application of a reliable jury rudder is of greater importance than ever.



CAPTAIN WAKE'S JURY RUDDER.

We give an illustration of a jury rudder which was fitted by Captain Wake to the s.s. *Grafton* (owned by Messrs. E.W. Morgan & Co., 3, Fenchurch Buildings, E.C.), by means of which he successfully navigated his vessel, partly without assistance, and partly whilst being towed from lat. 36° 21′ N., long. 19° 34′ E., to Malta.

The following extract from the log will give an idea of the difficulties under which Capt. Wake carried out this work.

Extract from log of s.s. *Grafton*, *re* jury rudder :—

"December 24, 1882.—Strong increasing wind, with hard squalls, and sea getting up again by 3 a.m.; wind had increased by a gale at 4 a.m. Heavy sea running 4.45 a.m.; rudder and rudder posts broke away from the ship, taking all chains and gear attached, also breaking two blades of propeller close off to boss, and pieces off the remaining two blades; had to lay ship to, with head to northward, under reefed fore and aft sails. At daylight, hoisted signals to a passing steamer to be reported. Noon: Continuation of stormy weather, with heavy sea; ship rolling heavily. P.M.: Ship still laying under fore and aft sails reefed. One p.m.: Signalled to the s.s. *Treninglos* to report us, which he promised to do. Midnight: Gale moderating; sea still running very high; pumps carefully attended. At noon, lat. by observation, 36° 21′ N.; lon., 19° 34′ E.

"December 25, 1882.—A.M.: Wind. westerly, decreasing; sea going down. At daylight, strong wind and unsettled weather. Eleven a.m.: Wind shifted to N.W.; wore ship round and started engines slow; crew employed rigging a jury rudder with a hawser and planks, weighted with chains and towed astern, bridled with warps from each quarter, led to winches; all available warps and ropes cut and used for bridles and lashings. Noon: Had squally and unsettled weather. P.M.: Strong wind from N.N.W.; squally unsettled weather, with high cross sea, and ship rolling heavily. Two p.m.: Commenced to steer with jury rudder; found it would answer satisfactorily if weather kept moderate. At sunset had strong wind, with terrific squalls; fore trysail split; fore staysail blown from roping, and main staysail opened at seams. Midnight, ship rolling very heavily; pumps regularly attended. At noon, lat. by observation, 36° 45′ N.; long., 20° 30′ E."

On December 26th, a jury rudder was shipped on which more reliance could be placed than on the floating planks weighted down to give them a hold in the water. We give an illustration of this jury rudder, and a copy of the report of Lloyd's Surveyor at Malta as follows :—

On the arrival of the s.s. *Grafton* in Malta, Captain Wake called my attention to the arrangements he had prepared for steering the vessel by means of a jury rudder, of which the following is a description, the reference letters being to the accompanying sketch.

The main derrick boom was unshipped and used as the main piece, the fore and afters from two of the hatchways were bolted to it, one on each side, and several narrow shifting boards on them forming the rudder shown at (*a*), this was slung over the taffrail, and secured by the lashing (*g*), the chains (*ff*) were passed under the foot and secured on deck, so that the rudder could be raised or lowered at will; stay-chains (*c c*) were fastened to the shackles for lifting propeller, and to chains (*ff*), to allow rudder to range freely the tackle (*e*) was secured to head of rudder on foot of after steering gear, to prevent rudder fouling with propeller in going astern; the rudder worked by the chains (*b b*) rove through the hawse rings at each quarter, the ends of these chains being connected with the ends of rope (*d d*), which had four turns round the barrel of after winch, and, according to the direction given to winch, so the rudder was brought over to port or starboard.

At my suggestion the rudder was fixed and tried when vessel was taken from the Great Harbour to the Hydraulic Dock in the Quarantine Harbour on the 10th instant.

Two steam launches were in attendance inside the harbour, but were not called on to render any assistance until vessel was brought at the dock; outside the harbour they were cast adrift, and the rudder tried in every way. I accompanied vessel round, and found the rudder to be fully capable of steering vessel. In coming out of the Great Harbour the ship was manœuvred amongst the shipping with the greatest nicety and ease; and outside, when launches were sent away, she turned to port and starboard with great readiness, and made a full circle to port in about six lengths of the vessel, making the Quarantine Harbour without the least assistance.

The weather was calm, with a slight breeze from the S.W.

(Signed) WM. HINCHCLIFFE,
Surveyor, Lloyd's Register.
Malta, January 27th 1883.

The seamanship and ingenuity of Captain Wake to meet a dire emergency is very apparent by the foregoing accounts; but why should seamen be reduced to such dependence on their own exertions, with such exceeding crude and complicated appliances, when marine engineering skill has devised many simple and ready means by which such requirements could be met.

The great drawback is, that the sailor looks with supreme contempt on any improvement or invention; and it is well known that every new appliance is, as soon as possible, stowed away out of sight by Jack, and when the time comes that it is required, it is more difficult to get at it than to knock together some rough jury appliance.

There is no doubt, however, that if proper attention was paid to the importance of new inventions, and such discipline maintained that they might be put into use at a moment's notice, a great amount of time and labour might be saved, a more complete and effective service obtained, and the severe damage, or total loss of many fine vessels entirely averted.

One appliance we would draw attention to which would have met the case of the *Grafton* with about five minutes preparation, is the combination sea anchor, jury rudder, life-raft, &c., invented by Messrs. Bullivant & Co., of 72, Mark-lane, London, E.C., of which we give an illustration and description in our issue of September 1st, 1882.

ON MODERN MERCHANT STEAMERS.

ABSTRACT OF DISCUSSION.

(*Continued from page* 260.)

MR. WILLIAM DENNY: The Admiralty, and especially Mr. Barnaby, may claim for themselves that in the matter of water-tight subdivision of mercantile hulls they have revolutionised the merchant service. Mr. Dunn has remarked that the division of a steamer's hull into many compartments involves some slight expense; but, although it may involve expense, I am able to say from the experience of shipowners that it involves also large conveniences. The steamers which trade between India and this country have not now only to do a service between terminal ports, but they have further to do a service between local and intermediate ports, and their owners find it of very great value that they have holds in which they may stow with ease the stowage for each separate port, and tackle it at once when they arrive there without disturbing the stowage for the terminal ports. What the Admiralty have done has the very largest influence upon the question of freeboard. We know that Lloyd's Committee, and I believe Mr. Rundell previously to them, introduced the idea of having surplus buoyancy as a measure of freeboard. Now surplus buoyancy has several meanings, but in connexion with this paper we may only assume it has one, that is the meaning that in the case of a ship being opened up to the sea either above or below, the greater your surplus buoyancy, the longer time she will be safe and take to sink, and the greater the chance you have either of saving life or saving the steamer. But, my lord, a steamer may have an enormous amount of surplus buoyancy, but if she has not proper subdivision, I venture to say she will sink, perhaps before a quarter of that surplus buoyancy is brought into action. Therefore, no rule as to surplus buoyancy neglecting subdivision by bulkheads can be valuable, and the ship which is well subdivided according to the Admiralty rule must claim and should be conceded a less freeboard than a ship that is not so subdivided upon that ground. One of the points to which Mr. Dunn has referred is the great increase of breadth in modern steamers. Now, my lord, I am an advocate of an increase of breadth so long as we know exactly what increase of breadth is doing for us and doing against us. Increase of breadth, if increase of draught of water can be got with it proportionate to the breadth is an unmitigated benefit; but if that increased draught of water cannot be got in proportion to the breadth, then there are certain disadvantages to be faced. Mr. Dunn has referred to one matter of great importance, and on which I have had some influence in introducing to the mercantile marine. That is the question of cellular double bottoms. I was not the gentleman who first started that idea, but I believe my firm was the firm which first made it known and a practical success. I will speak of the question of double-bottoms in so far as safety is concerned. I am happy to see in one way the diagram Mr. Dunn shows, a complete double bottom, built without wells for drainage purposes. When we first began working double bottoms we put these drainage wells, but Mr. Martell advised us as much as possible to discard them, and although we are occasionally compelled by some owners to put them in we do not do it of our own free will. A double bottom with wells, however well the valves may be fixed in them, is an unsafe thing, because everybody who knows what valves are in a steamer knows it is exceedingly likely they will not act when they are wanted to do so, and another thing is, in a double-bottom with wells, in the event of the double bottom being broken open there is a direct entrance into the ship for the sea if those valves do not act. There is only one further point on which I will say a word, and that is to endorse Mr. Dunn's views as to twin screws. Personally, I consider it an absurdity that power over 10,000 horse power should be put into one engine. I must say it seems to me when we have got to such excessive pressure, such pressure should be divided between two engines. I do not quite agree with Mr. White that a twin screw is the most efficient propeller, but even allowing it is not so efficient, but is even 5 per cent. less efficient than the single screw, I think the consideration of safety and the consideration of steering which Mr. Dunn has very properly mentioned, are considerations which should induce every prudent shipbuilder to consider the twin screw favourably.

Mr. MARTELL: I quite agree with Mr. Denny with reference to the praise he has given Mr. Dunn for this paper which has been brought before us. I think at the same time it is exceedingly creditable to the Admiralty that in addition to the amount of work which they must have to do in connexion with warships, that they should lay themselves out to afford information to the mercantile marine in the way they have done with regard to this paper. At the same time, as the Institution with which I am connected are supposed to have a great deal to do with merchant ships, seeing that we have something like 1,200,000 tons building under our survey, it would seem to be rather a damaging observation to say that the Admiralty really have a great deal more influence in this matter of safety with regard to this description of ships than an institution such as Lloyd's. I think it should be mentioned, however, in connexion with that question, that if Lloyd's Register Society had the power of holding out inducements to the owners of merchant ships in the way of employing them as the Government has, subject to certain things being done, they thought would be beneficial to their safety, they would have a great deal more influence than they have at the present time. The value that has been attached to what the Admiralty has done is no doubt greatly due to the inducements which they hold out to the owners of these ships that if they will do certain things with regard to the safety of the cargo and ships, such as fitting additional bulkheads, &c., they should have a preference with regard to carrying Government goods when opportunity offers. It is a most excellent thing, and I am very pleased indeed to think they have such a power within their hands, and that they can hold out inducements to shipowners to make these additionally safeguards. I can only hope they will keep faith with the public in these matters, and after owners have gone to the expense of making these additions as to safety, they will find that the additional expense incurred by them is rewarded by the selection of such ships as these when the opportunity arises for their employment. I think if they go on in that direction they will do a great deal more good than has been done up to the present time, because there is no doubt unless faith is kept in that way and that ships, where owners have gone to the great expense of making them additionally safe, will have an advantage when opportunity happens, it is very easy to imagine that they will not be so anxious to continue the improvements going on. There is no doubt the more a ship is divided into bulkheads the safer she is. That is evident. Every one must be confident of that, but though these subdivisions may suit the ships Mr. Denny has referred to, which have to discharge portions of cargo at different ports during a voyage, I can assure Mr. Denny that we have the greatest difficulty in persuading the general shipowning public that it is beneficial to their interest to divide them in this manner. The Committee of Lloyd's Register have recently had this case under their consideration, and the question is still occupying their attention, and there is no doubt the alterations they will make will go on in this direction; but at the same time with proper regard to the different interests involved and the requirements of trade, they have to be exceedingly careful how they move, and it is not until matters of this kind which they feel to be essentially necessary for the preservation of ships and for their safety, come before them, that they can be continually requiring alterations of this kind. I am very pleased to be able to say alterations of this kind, as far as are considered to be really necessary, are going on in this direction. I thoroughly appreciate and recognize the value of them in the safety of ships, and I say I hope not only in the large class of steamers, but in those of small size, we shall be able to further divide them in a somewhat similar manner to that shown. I ought not to occupy the attention of the meeting with regard to what has been said about buoyancy, because we shall have enough to say about that to-morrow; but there is only one observation I will make with regard to a remark of Mr. Denny's, and that is the question of surplus buoyancy is not only that of having sufficient surplus buoyancy after a ship is broken into by collision or other causes, but before the ship is injured in any way it is a matter of great importance to have a sufficient amount of surplus buoyancy to give her a sufficient lifting power to carry her over waves and to prevent her being inundated, and to prevent the waves washing the decks, or breaking into the deck openings. Therefore I cannot go the whole way with Mr. Denny in saying surplus buoyancy is no use at all unless you divide a ship out in that way; I think it is of some use; at the same time it would doubtless be of more use if you divided a ship further by bulkheads as suggested in this paper. As I have already said, I do not wish to occupy the attention of the meeting at too great length; it is a most able paper, it gives us a deal of information in connexion with the mercantile marine, particularly the large sized steamers, and I can only say I am very much obliged to Mr. Dunn, and I am sure in saying this I speak for those who are the owners of and interested in the mercantile steam shipping generally, to Mr. Reed and the Admiralty likewise, because it shows such a vastly improved state of things when they collect information of this kind in connexion with the mercantile marine to come and place it before the public for the benefit of all concerned.

Mr. W. H. **White**: I will speak very shortly, and only on four of the points which Mr. Dunn has raised. First with reference to the use of twin screws in the mercantile marine. I am quite open to conviction there, if it can be proved that twin screws in mercantile ships are not so economical as single screws. Having had rather exceptional opportunities of examining into the facts, I am distinctly of the contrary opinion, and I believe if the owners of ships of high power embark in twin screws they will find they have got the advantage of better subdivision, greater precaution against entire disablement, associated with, if anything, a better performance. There may be departures from that view, but I am speaking now of sea-going, deep-draught ships; I am referring not merely to the result of model experiments, but to the result of large scale experiments, which Mr. Parker knows more about than I do, in some of those twin screws of the Hill type, which have been recently built, and to which Mr. Denny has alluded. Secondly, as regards the water-tight subdivision, Mr. Dunn has pointed out what is a very important aspect of the question. But he has put so many important matters forward that I think this might be overlooked, therefore I mention it. You may have plenty of bulkheads in a ship and they may be utterly useless to you. That may arise from too deep loading in relation to the heights to which the bulkheads go, or to the want of proper consideration of the necessity of, or omitting, horizontal plating in the vertical bulkheads. That is to say, to take any general law except it has been tested carefully for a particular type of ship, would be dangerous and misleading; and to consider water-tight subdivision independent of load line is absurd. Then as to improved pumping facilities, I look upon pumps as being of little value as regards the power of keeping ships afloat. But if you have a ship with numerous water subdivisions, which is a thing always ready for use, a thing which does not want to be cared for if the doors and valves are closed, if that is ready, then when the time of accident comes, the captain has the assurance of being able to keep the vessel afloat. As to steam steering gear in the ships in the mercantile navy which I have had the opportunity of observing, I have been surprised to find rudders which are not one-half so great as we are commonly accustomed to see in ships of war; I am speaking now proportionately to their dimensions. Now, of course, the designer of a merchant ship has other things to think of than extreme handiness. In warships that is a very important condition. But supposing nothing else can be touched in a merchant ship, that her form is left unaltered and her proportions are identical with what they would otherwise be, it is possible to alter the rudder area; and I need scarcely say the question of the angle of velocity, that is to say the readiness of the ship to answer her helm under critical circumstances, varies considerably with the increase of the rudder area. But where there is only manual power, if you had a large rudder area, that alters the condition altogether, because it could only be put over slowly at considerable angles, but now we have steam steering gear so powerful that the largest rudders that could be wanted at all could be put over and adjusted to the largest angles wanted in something like a quarter of a minute. It does seem to me that a possible source of safety is being thrown away if the rudder area of merchant ships is not made larger in the future than it has been in the past.

Mr. W. **Parker**: Mr. White having mentioned my name in connexion with twin screws *versus* single screws for steamship propulsion, I beg to offer a few observations on that question. Since Mr. White read his very able paper in 1878 on the efficiency of twin screws as compared with single screws fitted in vessels belonging to H.M.'s Navy, I have taken considerable interest in the subject, and for some time past have been collecting data from large steamers in the mercantile marine with a view to comparing, as Mr. White did, the work performed by two vessels of about the same dimensions, power, and draught of water, one fitted with twin screws, the other fitted with a single screw. The most recent additions to the high-powered Atlantic steamers have done so little work up to the present time that it is impossible to determine with any degree of certainty what advantage would have been gained had these vessels been fitted with two propellers instead of one, but as far as my investigations go with smaller vessels—say from 4,500 tons to 4,000 tons, and an indicated horse power of about 3,000 (I refer to the twin screw steamers, *Scotia*, *Notting Hill*, *Ludgate Hill*, and *Tower Hill*)—I feel quite sure in my own mind that these large vessels would have been propelled at very much less cost as regards consumption of coal if they had been fitted with twin screws. The advantages, so far as I can see, to be claimed for twin screws in vessels of exceptionally high power and with a limited draught of water are, 1st, a more efficient and economical means of propulsion in consequence of the pitch and surface of each propeller being so proportioned as to give better results than in the case of a single propeller: 2nd, an advantage is to be obtained by dividing large engines, say of 10,000 indicated horse power, into two parts so far as regards taking to pieces each part, overhauling and keeping the machinery in good working order. The parts that have to be lifted or moved now in these large engines are of such an enormous weight, and the necessary overhauling takes so much time, that it is very questionable whether these engines can, as vessels are now run, be kept in true working condition, and another important question arises, viz., whether these large parts have not become so heavy and cumbersome that a very great risk is run as to getting them sound. We have a good example of this in the case of the *Servia*, in which case it will be remembered one of her crankshafts, which had been made solid, was found to be so unsound that after the engines had made only a few revolutions it was condemned, and the vessel had to remain at the Tail of the Bank some six or seven weeks until another shaft could be made. The third point is safety. There can be little question that a vessel fitted with two screws and two separate engines, must be much safer than one fitted with only one large engine, especially if it is admitted that there is a doubt as to the soundness of the parts of the one engine. A vessel capable of steaming fourteen knots with two propellers would be perfectly safe and able to steam from nine to ten knots with only one of these propellers. She would not only be able to keep off a lee shore and be perfectly seaworthy, but would make an ordinary passage. As an illustration of this I may mention that the twin screw steamer *Hibernia*, belonging to the Telegraph Maintenance Company, of over 3,000 tons, and 1,800 indicated horse power, capable of steaming about twelve knots, some years ago was loaded with a cargo of grain at San Francisco for London, and when steaming down to the Cape her starboard engine unfortunately broke down, the shaft of the broken engine was disconnected, allowing the propeller to revolve, and with the other engine she continued her voyage at the rate of nine knots per hour until she reached the equator. By this time the engineers had repaired the broken engine, and the vessel again proceeded at her original speed of twelve knots; but strange to say, when off the Start in the English Channel the port engine broke down and the vessel was again safely steamed with one engine to London. These are facts which, I think, go far to prove that a vessel with twin screws is very much safer than a vessel fitted with a single screw only. The objection to fitting these large steamers with twin screws does not arise from shipbuilders or engineers, but from owners who are advised by their nautical managers (and I think very rightly) that to dock twin vessels, especially in a port like Liverpool, where a strong tide, and very often strong winds prevail, there is great risk of carrying away some of the blades of the propeller, and thus with a ship fully laden and ready to start on her voyage, with her complement of passengers, a great deal of inconvenience might occur and great expense be involved. I admit all this, but to my mind it is the wrong way to look at the problem, the vessels would be liable to carry away their propeller blades because the entrance to the docks are so constructed that the vessels' counters at high water overlap the pier-heads, and consequently the propellers would strike the dock wall. But the answer to this objection in my opinion is, *alter the dock walls*; the docks were made for the ships, and not the ships for the docks, and I feel sure that if twin screws can be proved to be a more economical means of propelling our large high-powered Atlantic steamers than single screws, then the Dock and Harbour Boards must alter their arrangements.

Mr. A. C. KIRK: The subject of twin screws has been practically exhausted. Much has been said about the difficulty of docking, but nobody has said anything about the increased facility of docking the twin screw affords. In Liverpool with a single screw you get pulled round and there is very great difficulty, whereas with a twin screw, while a ship has no way on her, you can, so to speak, steer her. In going down the Clyde in one of Her Majesty's steamers, just to give an instance of what has been done with a twin screw, the steering gear practically became quite useless at an early stage of the journey. She had no steam steering gear, but by getting down a good gang of riggers to the steering wheel, without steam that ship was safely steered down the Clyde to the tail of the bend purely by the two engines alone. I will not say anything I think as to the matter of pumping power, the question is whether the power is properly applied in a steamer in order to keep her afloat. I think Mr. Parker and Mr. White are both right. They have looked at it from two somewhat different points of view. Mr. Parker is perfectly right; if water gets into a stokehole as quickly from above as it does from below, then the fire will be put out and the whole ship become unmanageable, the pumps will master that condition of things perfectly well. Mr. Macfarlane Gray suggested a test of pumps, but a test of pumps to be of any use in that case would require to be a test addressed to a set of pumps pumping about half coals and half water, or as I have known, even a whole lot of tallow candles which had got in.

Mr. RAVENHILL: Having had the honour some years ago of bringing under the notice of the Institution the great strides which had then been made in the speed of some of the passenger steamers across the Atlantic, I venture to trouble you again this afternoon for a few minutes. Since that date no doubt very, very great progress has been made. We have heard to-day of the *Stirling Castle*. I may tell you that her speed at the mile the other day was 18.[illegible] knots, with 100 lb. of steam. Now if that vessel reaches the speed that those who are connected with her hope and anticipate, she is to bring home her cargo of tea at something like 16 knots an hour. One word about twin screws and the advantages *pro* and *con.* as compared with the single screw. It has been discussed oftentimes in this Institution, and from my own experience many years ago, there was no doubt about it we did get a better result with twin screws than we did with a single screw. You have the greatly increased safety, as has been mentioned by previous speakers here this afternoon, when you are using twin screws as compared with single; you have also this greater advantage that you can subdivide your vessel by the fore and aft bulkheads in the way our Navy vessels are now fitted, if the twin screw system is adopted in our large range ocean-going steamers.

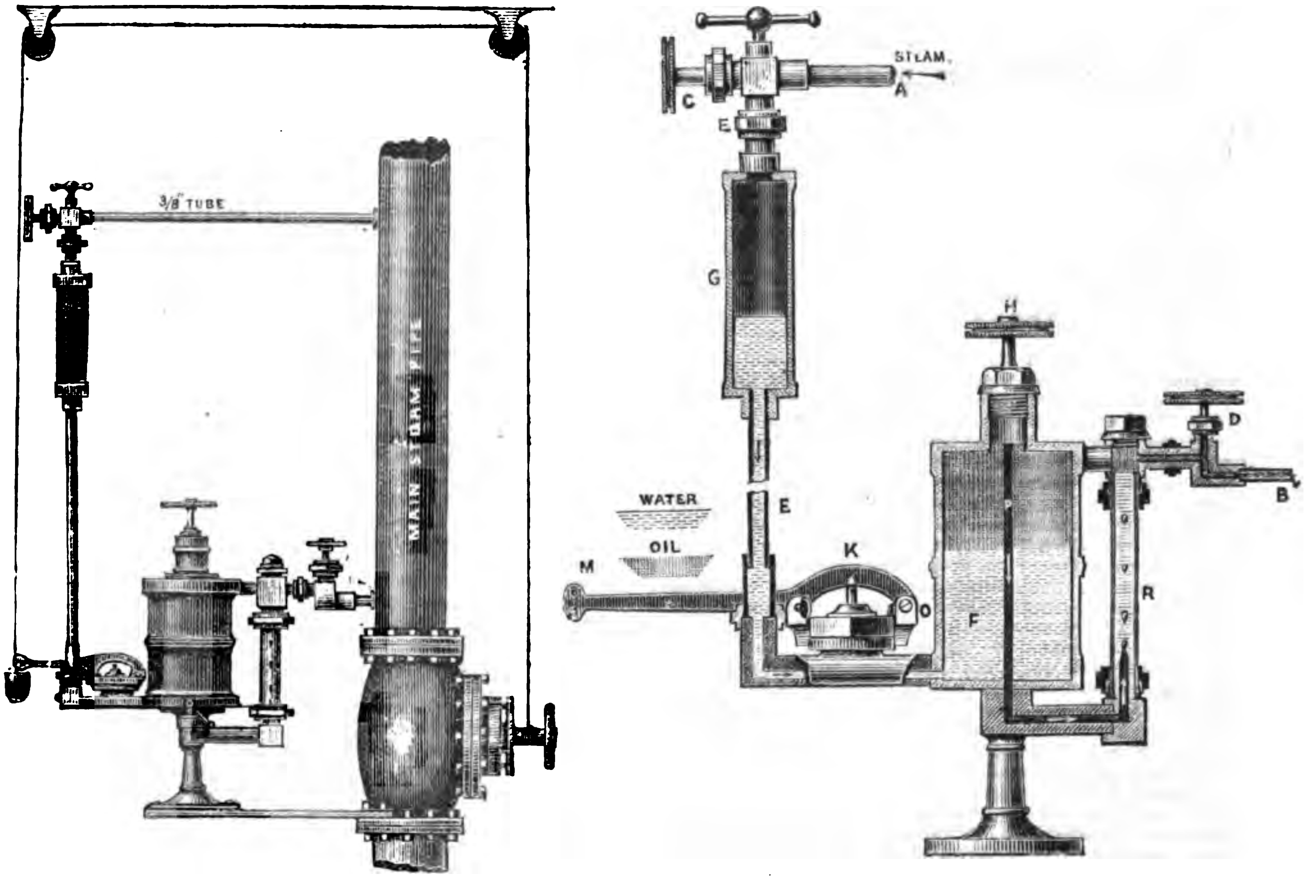
Mr. REYNOLDS: The remarks that have been made in praise of twin screws may be taken almost as truisms, but I should like to know whether our merchant ships are in the habit and whether they are likely to display any of the eccentricities of steering that some of our ironclads have done. The last trial of the *Inflexible* showed that she required to carry her helm 18½ deg. one way, and sometimes another. Then in correction of Mr. Parker I may say that one at least of those ships has in one of her passages damaged both of her screws. The blades were bent, showing possibly that there may have been a little of that eccentricity of steering, and showing also practically they are a little more liable to damage.

Mr. JOHN: As the matter has been practically exhausted, I will only refer to one point in Mr. Dunn's paper, and that is the question of bulkheads. The question of bulkheads comes up periodically, and is ventilated here. There are difficulties about the question which I should like to point out, and which I have always felt from many years' connexion with Lloyd's, and I am afraid there will always be the same difficulties. In the first place I should like to say that as far as passenger ships are concerned, where it is a question of human life, I fully endorse all that has been said about ships being so subdivided that they will not sink if one compartment is flooded. That should be carried out and enforced by the Government of this country, and should not be left to shipowners or Lloyd's, or any other body. When it comes to a question of property the whole matter is changed entirely, as I will show you. You take a sailing ship, you take the iron sailing ships of this day up to 1500 tons or 2000 tons. They have only a single collision bulkhead in the bow, and if Lloyd's were to attempt to enforce a subdivision of those sailing ships they would be met with such an outcry from the owners of those ships that they could not maintain their position for a day. What is more they would so cripple the taxation of those ships, and for so small a gain, that they could not maintain it. Because those ships are amongst the safest ships in the country, they are the ships the underwriters pay the least premiums upon, and Lloyd's could not interfere with them. Now when it comes to cargo steamers, Lloyd's naturally recognise that at the stern there are the dangers in connexion with the propeller shaft, and they have a bulkhead there; in addition they have also bulkheads at the ends of the engine-room—the machinery compartments. They are necessary bulkheads, but when it comes to forming a further subdivision they would be met in this way, Our owner says No; in some trades it is valueless, in others it is a necessity of the trade, and they do it as a matter of course for the purpose pointed out by Mr. Denny, of calling from port to port, but where it suits an owner's trade to have a large hold, a fore hold, and a large after hold, for Lloyd's or anybody to say No, you must have bulkheads to divide the ship, I ask what is the position of Lloyd's if the owner says "No"? Here I cannot only dispense with those two bulkheads, but I can take out those three bulkheads, and turn the ship into a safe sailing ship, and unless you are able to enforce that principle through the whole of the weight-carrying ships, sailing ships as well as steamers, you cannot adopt the principle that an iron ship must be so subdivided that one compartment can be flooded without the ship going down. Therefore I say we must recognise that feature of the thing as one of the salient points. There is only one other point I would mention, it is about the double bottom. I think Lloyd's require a well at the end of each compartment, and that is another case where to prevent or to minimise damage to cargo some sacrifice of safety takes place. And you cannot help it, because you may dispense with the double-bottom altogether, and the double bottom as it is now in the mercantile marine would never have been introduced for the purpose merely of safety, but for other considerations—economical considerations—and therefore you have it for the purposes of trade. You have those wells which Mr. Denny advocated as a matter of safety, but it is not so very large, because you have the double bottom throughout the other parts of the ship, and it is only on the off chance of your happening to damage the outside skin in the neighbourhood of that particular well that you get the benefit of it. I wish to dwell upon the point that double bottoms in the merchant service are not for the purpose of safety, although they contribute in that direction, and would never have been used if it had not been for economical and commercial reasons.

Mr. W. Rundell: Like Mr. John my intention is to speak to one point only relating to the bulkheads. There was an experiment tried by the Registry more than twenty years ago. They offered a better class on the introduction of a sufficient number of bulkheads to insure a moderate degree of safety at sea. The basis, I may say, of the arrangement was this; the spare buoyancy being assumed at 30 per cent. it was thought that if no part of the vessel separated by bulkheads exceeded 20 per cent., under ordinary circumstances the ship would be safe, because there would be a good margin beyond, there would be the margin of 10 per cent. Now a gentleman who is very ardent in this matter, built a sailing ship so as to suit this arrangement, and she was specially designed to have these five bulkheads, but he found it interfered with him in very many important respects. He found he could not earn the freights he might have earned if the bulkheads had not been there, that the ship was only adapted to certain cargoes, and that it was an entire loss. Now the case is rather different with regard to steamers, because steamers have usually an increased number of bulkheads. It is nothing unusual for a steamer to have seven, eight, or nine, but at all events more than five. Here the difficulty did not lie with the number of bulkheads, but the spacing, because the rule was that the ship should be so spaced as not to enclose more than 20 per cent. of the total bulk of the vessel. If they enclosed more than that they were useless. Now taking another point of view, supposing you had a number of bulkheads and no division of the vessel occupied more than 20 per cent. of the total bulk, the underwriters would look at the matter to see whether she was as safe as regards ordinary casualties. But on the question of collision, if a collision happened and two compartments were flooded, the additional number of bulkheads would be of no service. But I may point out, the case is considerably altered now by having the double bottom arrangement, that conduces quite as much, perhaps more, to the safety of the vessel than the division of bulkheads. I know one case where a vessel with a serious rent was going to sea again without its being known there was any injury in the double bottom, till they were pumping: they wanted to clear the tank, and they found it was not possible to do it. As Mr. White says, they were pumping the sea up, the rent was so big that there was no possibility of clearing it.

BOULT BROS. PATENT LUBRICANT.

THIS highly serviceable lubricant which is known as Baird's Automatic Light-Feed Oil Cup, has been designed to enable engineers to regulate to a nicety the quantity of lubricant they wish to supply to their engines. This is so arranged that as the oil goes up through the water in the gauge glass, a drop at a time, the engineer can find out how many drops to the minute his engine needs, and keep the oil flowing at the required rate.



BOULT BROS. PATENT LUBRICANT

By this means there is no waste, and the oil being enclosed no dirt can get to it. The method of working is to fill the glass with clear water, completely fill the cup with oil, in order to drive out all air, then turn on steam and wait till the condenser B has had time to fill with water; then put the water pressure on first by releasing the lever G, then slightly open valve D, and wait till the drops are rising freely before regulating the flow to the number required per minute. After being once started, this cup requires no more attention until it wants refilling, when if the engine is working, valves C and D must be closed, the plug F taken out, and then the waste water run off; if engine is standing C is closed automatically. Should the lever G not be connected with the engine, this valve will of course require to be shut and opened by hand.

This arrangement has a great advantage over any other cup, because being a sight-feed, it may be worked automatically by attaching the lever G to any handle or part of the engine which is moved when starting or stopping; if more convenient it can be worked by the thumb-screw H. On account of the well known wastage of oil and the heating of bearings caused by a bad supply of lubricant, this invention will readily recommend itself to all engineers, and will, no doubt, soon become one of the most prominent attachments of marine and other engines.

THE VENTILATION OF SHIPS.—No. 6.

BEFORE offering any remarks upon other inventions for the ventilation of enclosed spaces in ships, we will make a few observations upon the ventilation of cattle receptacles therein, and also a few more statements concerning explosions on board ships from further information which has come to our notice. Communications have taken place between the Board of Trade and the Veterinary Department of the Privy Council Office, with the view of devising some means of ameliorating the sufferings of animals conveyed in ships across the Atlantic, and diminishing the annual losses which occur during the voyages from want of proper ventilation of the receptacles in which the cattle are carried. On August 27, 1880, a circular was sent from this Government Department, signed by the Clerk of the Council, the importance of the statements of which are well worth quoting. He says that he was instructed by the Lords of the Council to inform them, "that their attention had been called upon several occasions to the sufferings of animals on their passage across the Atlantic, caused by an insufficient supply of air in certain states of the weather, and also by exposure on deck in the depth of winter. Their Lordships are of opinion that notwithstanding the considerable success with which the carrying of animals across the Atlantic is attended at this time of the year, in the majority of vessels employed in the cattle trade, there is much which might still be done to improve the ventilation where it may be necessary that the hatches should be battened down; or when, in the hot season of the year, or at any time the supply of fresh air to the more remote parts of the deck on which the animals are carried below may be insufficient. Their Lordships are advised that air-pumps might be fitted, and also exhaust or up-take ventilators into funnel, or funnel casing; and when, as is usually the case, the masts are iron, they might be adapted as ventilators; that large ventilators, or a system of ventilation of large capacity, should be placed quite in the extremities of the cattle decks, and that they, or it, should be of such a description and height as to be able to be kept open, or working, in all weathers. . . . In hot weather the air pumps would be of great importance, so as to remove the foul air, and to ensure a proper system of ventilation to the remote and confined parts of the decks below, where animals are carried."

In answer to our inquiry from the professional officer of the Veterinary Department of the Privy Council Officer, respecting further information relating to this subject, he has kindly furnished us with a Report on the Transit of Animals from Ireland to Ports in Great Britain, with an Appendix prepared by the last-mentioned department, in 1878; and an Order in Council of the following year called "The Animals Order." He has also referred us to other published Parliamentary Papers relating to the conveyance of animals on board ships, and from which papers, as well as those that by his instructions were sent to us, we have obtained some appreciable facts and opinions concerning the ventilation of cattle-pens in ships, the essential portion of which we will now communicate.

In consequence of the Select Committee of the House of Commons on Cattle Plague and Importation of Live Stock, which was published in 1877, having recommended "that a searching inquiry should be made into the subject of the transit of cattle from Ireland to the ports of Great Britain; into the provisions made for their reception at the ports of departure and of arrival, and into their treatment during the voyage," the Lord President of the Council, in the last month of that year, directed Professor Brown, the chief officer, of the Veterinary Department of the Council, to make an inquiry respecting the treatment of animals during the voyage from Ireland to Great Britain. Two of the travelling inspectors, Mr. Courtney and Captain Tennent, made a very careful inquiry upon the above subject, under Professor Brown's directions, and their reports on the same are published in the appendix to the Professional Officer's Report on the "Transit of Animals from Ireland to ports in Great Britain." According to a statement of the latter in this document, "ventilation is generally provided by means of separate inlet and outlet openings in accordance with Article 44 of the Order of 1875; but when vessels are lying off the quays, or waiting for a tide, animals often suffer from insufficient air." Mr. Courtney tells us that as cattle are frequently embarked in a heated and excited condition, "the atmosphere of the 'tween decks and holds becomes charged with steam and is almost unbearable, and the animals are generally landed in an exhausted condition. As a contrast, I have seen an equal number occupying the same space, but which had been detained at one of the depôts for some hours; these came on board cool and quiet, and were landed looking fresh and comfortable." He adds, that he thought it highly necessary that, previous to the animals being shipped, they should for some hours be detained in the neighbourhood of the place of embarkation, so that they could have food and water, and become cool before commencing their voyage. He further says, that "animals often lie down when not crowded, and appear to travel better in that position; but when crowded, if once down, they cannot get up again without assistance, and run great risk of suffocation. . . . Full grown and fat cattle are always tied up during the passage, but yearlings and other stores seldom are, except in vessels belonging to the London and North-Western Railway Company, trading between Ireland and Holyhead." He thinks that if this practice were generally adopted, overcrowding of cattle in ships would be diminished to a great extent. From information he received from drovers, agents, master mariners, and others, Mr. Courtney is clearly of opinion that in the months of June, July, and August, during which period store cattle are brought over in great numbers, overcrowding occurs to a great extent; and he has noticed that in these months, when inspecting the cattle conveyed, that they have been landed at the different ports in a most exhausted state. Captain Tennant also states that he had been told by many dealers, drovers, and others, that when the cattle trade is active, during the summer months, "almost all the ships plying from Ireland to Great Britain are frequently very much overcrowded." This travelling inspector, in an account of a passage by him from Dublin to London, in the ss. *Cavan*, on the 14th of December, 1877, states that about three hours and a half after the ship commenced her voyage, which occupied about twelve hours, he visited the lower and middle holds, in which some of the cattle were placed, but he was unable to go in far, as "the only means of passing from the hatchway was by climbing over the backs of the animals; and the atmosphere, more especially in the lower hold, was, although not very hot, exceedingly oppressive, and soon produced a feeling of faintness. The drovers appeared very attentive, but they seemed to have great difficulty in getting the beasts that fell from time to time on to their legs again, on account of the want of room. . . . One animal from the middle hold had to be slung on deck, and after remaining there in the fresh air for a few minutes was able to walk on shore. Another had to be killed in the lower hold, and the wound in its throat was so dark in colour, as to suggest the idea that it had suffered from suffocation." In his report of a passage in the ss. *Lord Gough*, from Dublin to Glasgow, on Jan. 3rd, 1878, he says that he was informed by one of the officers, that during the season the ship frequently conveyed 200 or 300 cattle. "As they were often carried in the middle and lower decks, and as the ship was not fitted with brows or cattle-ladders, the animals had to be slung in and out of the holds. So far as I could see the after, middle, and lower holds have no ventilation at all, except by means of the hatchway, and the fore, middle, and lower holds, have only one small ventilation between them." In an account of another passage from Larne to Stranraer, four days subsequently, in the ss. *Princess Beatrice*, which carried about fifty lean cattle, he says that he was told that this ship had carried, during the then past year, no less than 29,000 head of cattle, in addition to sheep, goats, swine, and horses. So far, however, as he could ascertain, she had only one ventilator each to her middle and lower holds, in which, when she had a large cargo, cattle were carried. According to the Animals Order of 1879, of the Privy Council, Chapter 21, it is provided that, (1) "Every place used for animals on board a vessel shall be divided into pens by substantial divisions. (2) Each pen shall not exceed 9 feet in breadth, or 15 feet in length. (3) The floor of each pen shall, in order to prevent slipping, be strewn with a proper quantity of litter or sand, or other proper substance, or be fitted with battens or other proper footholds. (4) Every such place if enclosed shall be ventilated by separate inlet and outlet openings, of such size and position, as will secure a proper supply of air to the place in all states of weather."

In the evidence given before the Committee appointed by the Lord President of the Council, upon the Transit of Animals by Sea and Land, 1870, some important testimony is notified of the sufferings of cattle from the defective ventilation of the receptacles in which they are carried in ships. Mr. S. G. Holmans, one of the Veterinary Surgeons to the Board of Customs, said, the difficulty as to ventilation of cattle-ships arises when a vessel arrives in port; and adds, that he has noticed "more harm to arise during a stoppage of that sort than during the whole voyage, because the ventilation ceases." Again, Mr. Joseph Lloyd, Corporation Inspector of Meat and Animals, at Liverpool, said, as to the overcrowding of cattle-pens, that on going down into them he was compelled to turn back, as "the effluvia was so bad, it took the eyesight out of me. I have seen beasts completely blind for a considerable time; they have stood, and did not know where to go to." Some important correspondence and reports have been published, in 1880 and 1881, relating to the conveyance of animals on board British Merchant Steamships, to the Marine Department, Board of Trade, a few observations from which we think it opportune to notify. According to an extract from the report of the Liverpool principal officer of the Board of Trade to that Department, respecting the steamships bringing live stock across the Atlantic to Liverpool during January, 1880, it appears that the ss. *Massachusetts*, that carried cattle on the 'tween decks, were all improperly constructed pens: the vessel encountered very severe weather, whereby the hatches had to be battened down, in consequence of which, in the opinion both of Mr. W. H. Laslett, surveyor to the principal officer and the veterinary inspector, the cattle died. It appears also from the Report of the Principal Officer, London, to the Board of Trade, that on the ss. *James C. Stevenson*, bound from Baltimore to London, with 13 horses and 378 bullocks, that five days after leaving the former place, the hatches of the vessel were obliged to be put on, in consequence of the ship falling in with a very heavy gale of wind, and a great portion of the cattle on the main deck were smothered. We are told that "the fittings were all down when the ship was visited in Millwall Dock. Height of 'tween decks 6½ feet." Mr. F. Wake, the surveyor to this Principal Officer, in his further remarks upon such ship, states that the chief officer informed him that "there is no doubt this vessel met with a most fearful gale, and laboured to that degree that there was great danger of her foundering. The chief officer informed me that one sea carried twenty-five head of cattle overboard, and smashed up the fittings, and started the iron wash-streak round the deck. The cattle on the main deck, no doubt, were smothered from the hatches being obliged to be kept on for a considerable time."

In a letter from the principal officer, at Liverpool, of the Board of Trade to the assistant secretary, Marine Department, on the 23rd of February, 1880, in which he forwarded for the information of the Board the report of the surveyor respecting the loss of 254 of the 396 head of cattle carried on board the ss. *Canopus*, it appears that this enormous loss of these animals "is accounted for by 219 of those carried between decks, dying after the hatchway had been battened down; which was done in consequence of the four booby hatches which were fitted being carried away." With regard to the remaining 35, which were carried on the upper deck, these were either washed overboard or died on board. There were no cowls or other means of ventilation for the cattle in the 'tween decks; and side scuttles were fitted all fore and aft in them, but were all covered up by the dead lights.

It appears, from a summary of the monthly reports received from the principal officers to the Board of Trade, showing the number of animals shipped from ports in the Atlantic during the year ending February, 1881, and the number of each kind lost, and causes of deaths, that 62 oxen died from want of ventilation below, which were shipped in the s.s. *Lumperts* from New York to London, in November, 1880, and which were carried in the 'tween and weather decks. The total number of bullocks carried were 310. Captain Curtis, travelling inspector of shipped cattle, in a letter to the Veterinary Department of the Privy Council Office on the 24th of July, 1880, states that "it should be obligatory to have large ventilators quite in the extremities of the cattle decks, and of a sort and height which can be kept open in all weathers. I should attach great importance to air pumps in summer, and to the ventilation of *cul de sacs*, if I may so call them, of the vessel. The cattle lost in the summer on the voyage, from all the information I can gather, die more from the blood poisoning or fever engendered by the foul air, &c., than from suffocation actually, and the deaths seem invariably to occur in one or more particular parts or corners of the cattle decks."

An exceedingly grievous case of the suffocation of 300 sheep for want of ventilation of the receptacle of the ship in which they were conveyed from Iceland to Liverpool is related in the *Agricultural Gazette* for the 18th of December, 1876. This unfortunate occurrence is so startling and distressing that we cannot reasonably omit to mention it. It appears, from the report of this case, which was tried before the stipendiary magistrate at Liverpool, Mr. Raffles, that a Peter M'Caffle was charged with carrying sheep on board the s.s. *Frankfort* in a receptacle divided into pens, but the floors of which had not proper battens or footholds. He was further accused of having the place in which the sheep were conveyed improperly ventilated by proper inlet and outlet openings of of such size and position as to obtain a sufficient supply of air to the enclosed spaces in which the sheep were placed. The complaints on behalf of the Veterinary Department of the Privy Council were supported by Mr. Morris, while Mr. Hawkins appeared for the defendant, and the case was watched on behalf of the charterers by Mr. Danger, so that it was well represented. It appeared from the statement of Mr. Morris that the ss. *Frankfort* left Seydisfjorde, Iceland, with a cargo of 1,500 sheep. She experienced very rough weather, and had, on the 12th inst., to put into St. Magnus Bay, Shetland Islands. She shortly afterwards left, and on the 14th called at Stornoway, where she remained about eighteen hours. The sheep began to die in two days after the vessel left Iceland, and on her arrival at Liverpool it was ascertained that no less than 300 had died on the voyage. Mr. J. W. T. Moore, M.R.C.V.S., Chief Inspector of the Veterinary Department of the Privy Council for Liverpool, stated that he had visited the ship and found that proper battens had not been provided for this steamer. "The dead sheep in the hold were saturated with blood, as he found that the sheep had been stuck as soon as they died, and the blood allowed to run on to the coals on which they had stood. Inspector Luya, of the Health Committee, said he saw 299 dead sheep on board the vessel, which, he said, no doubt had been suffocated, as the flesh was quite black. The stench in the hold was so great that he could not remain there any length of time. For the defence it was mentioned in evidence that this steamer, before leaving from Scotland, had been delivered to shipwrights to fit it up with every convenience for the safe voyage of the sheep. The vessel, which was eleven days on the voyage, encountered very bad weather, and this, it was alleged for the defence, would doubtless disarrange the ballast, and caused the sheep to be thrown about a good deal, and that due precaution had been taken to provide proper pens and ventilation for these animals. In delivering judgment the stipendiary magistrate stated that, while "he thought the first four charges of want of proper accommodation had not been made out, he would dismiss these informations. As regarded the other three, he thought sufficient ventilation had not been provided, and he should impose penalties of 40s. and costs in each of those cases." In commenting upon this case the *Agricultural Gazette* contains some very important remarks, which accord with our opinion respecting the ventilation of cattle ships, and which do not appear to have been noticed by the Veterinary Department of the Privy Council, as we think they should be. This newspaper states that from the account of the case, the particulars of which we have mentioned, and from enquiries made "it appears that considerable pains had been taken to provide proper pens for the sheep, and the ventilation was of the ordinary kind, by means of open hatchways and wind sails; but in the face of exceptionally bad weather these precautions broke down, as they often do. The whole difficulty in providing sufficient ventilation arises from the want of provisions for removing contaminated air, and for this want no perfection of arrangement for the admission of fresh air can possibly compensate. So long as a vessel is going at a high rate of speed, a sufficient current is created to set the stagnant air of the 'tween decks and holds in motion; but when coming slowly up the river, or lying still to wait for a tide, the ordinary wind sails or air shafts are useless as sources of supply, because the spaces below are already quite filled with gases, some of which are heavier than the atmosphere, and therefore offer an effectual barrier to its entrance. The only principle of ventilation which can be effectively applied to the holds of ships is that of pumping out the foul air when necessary, leaving the outer air to find its way into the space thus created. Some time ago we met with a vessel, built exclusively for the cattle trade, in which this principle was carried out in a most ingenious manner. The apparatus used is, we believe, patented in Germany, but it is not unreasonable to imagine that an engineer could contrive more than one plan of using one of the engine pipes for this purpose. In the case which is quoted it does not appear that there was any want of care in providing for the reception of the animals. Pens were erected, and each sheep had a separate compartment; but the most luxurious fittings, without a sufficient supply of needful air, are a delusion, and in this instance a large number of animals were suffocated, not on account of a scarcity of pure atmosphere, which existed without limit all round, but purely in consequence of the absence of any means of getting rid of the poisonous gases which barred the entrance of air as completely as if every opening had been hermetically sealed. Nothing which can be devised will render the transit of animals free from hardship under all circumstances. Particularly is this point true in regard to sea transit; but there are certain things which can be done, to wit, providing food and water and any necessary quantity of air." It is to be hoped that before long some means will be found to provide for better ventilation for animals conveyed in ships, and thus materially diminish the number of deaths, intense sufferings and sickness, to which they are now subjected for want of this important provision.

Before writing this portion of our article, we thought that important information might have been published concerning the enquiry of Admiral Luard's Committee on Coal Gas Explosions, referred to in our last number. We regret to state, however, that such has not been furnished. It appears, according to several London newspapers, respecting the result of the examination of this Committee with the view to ascertain whether the destruction of H.M.S. *Doterel* was caused by an explosion of xerotine siccative close to the magazine, the Committee has stated that the result of the last experiment instituted by this body in H.M.S. *Bullfinch* lead them to think that an explosion may have been produced through the action of this compound on board the *Doterel*, and that an explosion thus occasioned may have extended in such directions, and have resulted in the development of such power, and accompanied by the production of a large body of flames as to have caused the ignition of the gunpowder in the magazine of that ship. This Committee, which was strongly represented, consisted of Vice-Admiral W. G. Luard, C.B., Chairman; Professor F. A. Abel, C.B., Chemist to the War Department; Mr. W. W. Smyth, Chief Mineral Inspector to Woods and Forests; Mr. E. C. Warren, Chief Constructor at Pembroke Dockyard; Mr. Charles Icely, Chief Inspector of Machinery, R.N.; Mr. James Dunn, Assistant Constructor and Chief Draughtsman to the Admiralty; and Mr. W. Weston, Admiralty Chemist. It appears from the decision of such Committee that neither this body nor the other committees of the Admiralty, who have made investigations respecting the cause of explosions in British naval ships, have anything sufficiently discussed this subject. From information we have just received from the Admiralty the reports of the last committee of that Government Department upon gas explosions on board Her Majesty's ships and upon xerotine siccative, will shortly be published. Better opportunities will then be afforded for scientific men, other than those we have mentioned on Admiral Luard's Committee, to treat upon these subjects in a critical manner. Mr. Thomas Rowan, C.E., has very recently published an excellent pamphlet upon the *Doterel* explosion, which he tells us has been written with the object of directing attention to explosions on board ships from coal gas and xerotine siccative, "and in the hope that an enquiry on a more extended basis than has yet been instituted may not be very far distant." In this publication he states, after a long and critical argument upon the subject that "the conditions which must have been present on board the *Doterel* prior to the accident were: the formation of an inflammable and explosive atmosphere in front of and in immediate contact with the magazine, emanating from the xerotine siccative placed in the mast hole; ample opportunity given for the inflammable atmosphere to make its way into the interior of the magazine, the magazine not only containing gunpowder, but doubtless this explosive and inflammable atmosphere.

"How the inflammable atmosphere was first fired we have no evidence as yet to show, but it might have been at some distance from the masthole where the xerotine siccative was placed. We can suppose that where it came in contact with the open light the quantity of the benzoline vapour mixed with the air was only sufficient to cause it to inflame, but as the flame was carried back towards the mast hole, the source of the benzoline supply, it was present in sufficient quantity to produce a violent explosion.

"Referring to the sketch it will be seen that the preliminary explosion took place at the mast hole, and it was of such violence as to burst open the ship's side on the starboard side, the upper deck in that part being forced up, twisted, and wrenched about. The force there was quite sufficient to burst open the magazine, and thus to convey flame to its interior, when the second and more violent explosion took place. Had the atmosphere in the interior of the magazine been free from benzoline, it is probable that the explosion of the gunpowder might have been avoided, as it was packed in metal cases; as it was, however, the explosion of the gunpowder completed the disaster that had its commencement at the mast hole In the *Tilbury* there were two explosions, the first when the benzoline vapour fired, the second some thirty seconds afterwards, when the flame reached the gunpowder barrels. In the *Doterel* there were also two explosions, resulting from similar causes, and following one another at a similar interval of time."

Having come to these conclusions Mr. Rowan, in June last, addressed a letter to the Lords of the Admiralty, in which he stated that he thought "It is now evident to those competent to form an unbiassed opinion on the subject, that the accident was undoubtedly due in the first instance to: The ignition of the inflammable atmosphere produced by the volatilisation of xerotine siccative; that the first or preliminary explosion took place where this inflammable atmosphere came in contact with an open light; that between the spot where the preliminary explosion took place and communicating with the magazine, the atmosphere must have been fermented by the volatile and inflammable hydrocarbon which escapes from xerotine siccatine; that the preliminary explosion, which was severe, doubtless started or ruptured one or more of the bulkheads in the vicinity of the magazine, thus opening direct communication with its contents; that the inflammable atmosphere, as above stated, became the medium by which flame was conveyed from the open light where it first fired to the magazine and its contents; finally, that the explosion of the contents of the magazine by flame thus brought to it, occasioned the total loss of the ship. I would take the liberty of suggesting that in order to prevent flame thus being conveyed to the interior of magazines on board ship, the magazines should be constructed with an external shell, a span being left between the walls of the magazine and the shell, and that this span should be so ventilated that any lodgment of explosive and inflammable atmosphere could not take place." Mr. Rowan makes some strong observations against what he calls the indefinite and absolutely futile decision, which was made by Admiral Luard's Committee, respecting the part which coal gas or xerotine siccative might have taken in producing the accident to the *Doterel*. "This conclusion," he says, "reads more like an evasion of the question, couched in terms which might serve as a model of diplomatic reply to inconvenient questions, but which for scientific or practical purposes is worthless. . . It is not sufficient to know that coal gas or xerotine siccative, and other gases and vapours 'may' be the source of producing such accidents. The great practical question now is how best to prevent the recurrence of similar accidents? For it must not be lost sight of that these later accidents have not disclosed to us conditions that were before unknown, but are only repetitions of similar accidents, the conditions producing such having long before been unmistakably ascertained and pointed out, but unheeded. It is, therefore, time that the possibility of such accidents continuing to occur should be dealt with by adequate legislation." We hope that the reports of the Admiralty Committee upon explosions of coal gas in ships, and from xerotine siccative will soon be published in order that stringent statutory provisions should be enacted before the end of the present Parliamentary Session, to prevent explosions thus occurring, as it is, as we have before mentioned, practicable to avoid these terrible accidents.

Among other artificial methods which have been invented, used, and recommended for the ventilation of ships, the so-called Boyle system is the most conspicuous as an automatic means for this purpose. This consists of a combination of upcast and downcast ventilators, and which, in conjunction with an arrangement of pipes, create a continuous and generally a forcible current of fresh air between decks, and are so arranged when applied to passengers' quarters that not only is disagreeable draught avoided but the foul air is abstracted, except when in calm weather and when the ship to which it is applied is not in motion. The arrangement is an application of their mode of ventilating buildings, founded upon a previous invention of inlet and outlet pipe for this purpose.

The air pump, or upcast ventilator is so made that an up-draught is the result, no matter in what direction the wind may strike on it. It is also stated that no down-draught is experienced, and being a fixture and having no moveable parts to get out of order and does not require trimming, the ventilation cannot be diminished under favourable conditions by lack of attention. Again, although it is fixed on the deck in the same manner as an ordinary ventilator, we are informed that no water can pass through it. The inlet, or downcast ventilator, is also fixed upon the deck, and has pipes connected with it, which are carried to the saloon cabins, holds, engine-room, and other parts requiring ventilation. This shaft is also so constructed that while an appreciable supply of fresh air is sent below it will prevent the passage of any water. For the admission of this air the inlet ventilator has four openings contracted towards their entrance inside where they converge into one, and are arranged in such a manner as to catch the wind from every quarter, without the necessity of trimming. Inside and about one-third of the length of the pipe above deck is fixed an oblong pipe of a syphon character at the bottom of the bend, and a series of louvres are arranged round the sides so as to allow any water which might escape in at the before-mentioned openings, or mouths, of the ventilator to pass into the outside pipe, and then on to the deck through a suitable aperture. Both the main and branch extraction pipes, as well as the inlet pipes, can be concealed behind cornices, so as not to interfere with the decorations of the saloon and cabins. Small vertical tubes are also used to admit the air in an upward direction, so as to avoid draughts. These tubes, to cause the air supply to be entirely under control, are fitted with regulating valves, and the supply of air may, when desired, be warmed by having small steam pipes led along inside the branch pipes and connected with the boilers. The air supply can also be appreciably cooled by ice boxes placed in different positions of the shafts.

Mr. Boyle has also adopted an improved means of ventilating stokeholes of ships by doing away with the open gratings over the stokeholes, and except where the ventilating shafts penetrate, have everything tight at the top. On one side of the stokehole one of new downcast ventilators is fixed, and which has a shaft carried down to about four feet from the floor where the air is discharged, and on the other side of the stokehole an upcast ventilator is fixed with the shaft only just penetrating through. This ventilator absorbs the hot air from the highest level to which it naturally rises. There is no downward pressure of cold air from the top, and the hot air is absorbed very quickly, and is at the floor level replaced by cold fresh air, and just at the place where the stokers mostly want it. Any number and size of stokehole ventilators may be applied which may be required. The furnaces would also advantageously draw a good supply of air from the downcast shaft. Another advantage of having no gratings and everything tight above is that the passage of water below is prevented. The coal bunkers are also ventilated with the same shafts as those used for the stokehole. We have, however, no information as to what results have taken place from their application to these receptacles.

Messrs. Boyle have received many testimonials and newspaper press notices respecting the success of their ship ventilators, and which gained the "Burt" Prize of £50 at the London Shipwrights' International Exhibition in May last, the Gold Medal at the International Exhibition of Means and Appliances for the Protection and Preservation of Human Life, in the following July, and the First Prize at the North East Coast Naval Exhibition last October. These ventilators have been applied to several ships and vessels belonging to our leading lines and to several ships of the Royal Navy.

As far as we are able to judge one great disadvantage of the Boyle ventilators as applied to ships is that they cannot, in calm weather especially, abstract a sufficient quantity of vitiated air for lack of power to do so, and consequently, even if it is true that no down draught is experienced from them, and that no water can pass down their shafts, this defect is a very considerable one, and does not exist in the Norton ventilators, the suction force of which is very strong.

Another new patented ventilator for ships of an automatic kind, which we will briefly notify, is the one brought out by Messrs. Mosses & Mitchell, of 3, Crosby Square, London, E.C., and has been exhibited at Lloyd's. The apparatus consists of two wrought iron cylinders, placed on either side of a ship on board and connected by a pipe. These cylinders are filled partly with water, and on the rolling of the ship the water rushes from its elevated to its depressed side from one cylinder to the other, and by causing a vacuum abstracts the vitiated air from between decks, or out of the hold, by pipes leading below. The extracted air escapes through a discharge pipe over the side, and so great is the force of its exit that it can be used to blow a fog horn when required. Again, the cylinders can be so fixed as to be operated upon by the pitching as well as the rolling of the ship, while there is always a sufficient movement of the water to keep these pumps working. The use of this apparatus will remove the contaminated air from the bilges and under decks as well as other compartments of ships, and the air spaces created will be naturally filled up by pure atmosphere from the windsails, or ventilating funnels. According to the prescribed instructions to the engineers or ships' carpenters, prepared by Messrs. Mosses & Mitchell, the cross tube which connects the cylinders should be filled with fresh water until it rises in them two inches when the ship is on an upright keel. It is also recommended that at the end of each voyage the water should be drawn off and refilled from the top of the cylinder.

In addition to very favourable notices which have been published concerning this patented invention in the *Times* and the *Shipping and Mercantile Gazette*, many important testimonials have been sent to Messrs. Mosses & Mitchell respecting its use and efficiency. Admiral Sir William King Hall, after making experiments upon it on board H.M.S. *Vigilant*, states, in his report to the Lords Commissioners of the Admiralty, that "the results have been entirely and highly satisfactory, fulfilling all the conditions stated by the inventor most perfectly. Several medical men were on board and were convinced of the importance and great benefit which must arise were ships fitted upon this plan." Sir E. J. Reed, M.P., in writing to the Japanese Minister, says, "I have since learnt good accounts of the working of the apparatus in Her Majesty's transports, that I strongly advise the fitting of one of them to the mess deck of the ironclad *Foo-so*. The apparatus, I find, works with a very small amount of rolling in the ship, so that even when in harbour it is often at work, while at sea, especially when rough weather requires the side lights, &c., to be closed, it is most valuable." Two sets of these ventilators have since been fitted to the Brazilian ironclad, *Independencia*. Rear-Admiral Hall states, "in the case of the *Orontes* the apparatus was effective with a roll of some 4 deg., and in that of the *Malabar* the ventilators commenced at a roll of 1 deg., and that it was most efficient." In a letter upon the working of this apparatus from Messrs. L. H. Macintyre & Co., shipowners of Liverpool, they inform Messrs. Mosses & Mitchell that "We think it due to you to state that we are much pleased with the action of your automatic ventilator as fitted in our ship, *Carbet Castle*. After a voyage we can say that it has acted admirably, sucking the heated air out of the ship and expelling it outside whilst, by means of open ventilators, fresh air is introduced to supply its place. The ship delivered her outward cargo of 2,157 tons of coals at Calcutta in a perfectly cool state, and recently her home cargo of wheat, linseed, &c., in a similar satisfactory manner. We heartily commend it to all to whom the safe delivery of heating cargoes is a desideratum." Commanding officers of the United States Navy have also well commended this system of ventilation as well as several medical men of various Nationalities. It has been fitted on several of Her Majesty's ships as well as on several other steamships and sailing vessels. The Indian Government has also ordered that all emigrant vessels leaving Calcutta with Coolies will be required in future to have two sets of the automatic ventilators on board.

According to the printed extracts from a letter received by Messrs. Mosses & Mitchell from Capt. D. Napier, of the ship *Neva*, 1173 tons register (which was fitted with two sets of their automatic ship ventilators), he makes, on the 21st of June, 1879, from Mauritius, a very important statement concerning the advantages of these ventilators for Coolie ships, which we think well worth quoting. He says, "Your system I can now verify by experience, having brought from Madras 445 Coolies, and nearly 15,000 bags of rice in lower hold; there having been only one death among the Coolies, an infant not expected to live when embarked. The cargo of rice is turning out in excellent order—no sweat from the cargo. The Coolies were forty-two days on board, and all landed in good health. Your automatic ventilators act with only 2 deg. of roll. The surgeon-superintendent took great pains from his having received instructions from the Madras Government to test the system. In his opinion, as also my own, it is absolutely necessary that all vessels carrying emigrants or troops, &c., should be fitted with these ventilators to preserve health. The surgeon-superintendent of the Coolies, Dr. Morton, has sent in to the Government an elaborate report of the tests by the air-meter, and also of the temperature of the between decks. We had strong winds in coming down the Trades, from 9 deg. to 15 deg. south lat., putting the ship under the lower topsail and foresail. For about 36 hours I had to close the windward hatchways, and partially close the lee, from the spray of the sea and the showers of heavy rain. During this time the Coolies had to be kept mostly below, and a few let up at a time, as their wants required. The between decks during this time remained perfectly free from any bad odour, except in the immediate approach of the hatchways. Under similar circumstances, I have found it impossible to remain below in the between decks without feeling nauseated, and being obliged to get into fresh air." Captain Reeves, of the barque *Umvoti*, writing from Calcutta on June 8th, 1881, says that "we have none of the disagreeable smells of Coolie stores in the holds that we used to have, and in anything like heavy weather it is self-evident to all the senses." The favourable opinions we have mentioned respecting Mosses & Mitchell's automatic ventilator will, we believe, apply to the one we have described (which has been applied by Captain Norton), and which is placed at the stern of the ship, inasmuch as the latter, when the ship is becalmed or in port, can be efficiently worked by manual labour. It must be borne in mind, however, that no automatic ventilators can be used in large steamships with anything like as good results for withdrawing contaminated air from their enclosed spaces as the power ventilators. So that, although the latter are more costly, they will be found in numerous cases to be the most truly economical in the end.

One of the most recent systems of ventilation which has come to our notice, and which possesses several important and novel merits, is one patented by Mr. Stanley, for the manufacture and fitting of which a joint stock company is to be established. Although this invention is patented for the express purpose of ventilating and purifying of air in mines and tunnels, it is stated that it may be used with advantage for purifying the air in ship saloons and cabins, as well as their engine-rooms and stoke-holes. With regard to saloons, this can be effected by pumping cold water through pipes fixed in the ceilings from a tank above, and which pipes run from the length of and across the saloon. Rods are fixed in these outside, from which a thin film of water trickles down, and which is regulated by a cap fitted to the upper end of the rod. In thus running down, the water will absorb all the suspended dust, and what may be floating in the air of the enclosed spaces down the fixed rods from which the water trickles. By this apparatus, too, the air therein may be cooled by the water, while its vitiated atmosphere can be disinfected by the mixture of chemicals with the water. The fluid, after running down the rods, is discharged by an arrangement of pipes under the flooring. A guard of brass wire gauze can be fixed to prevent persons or substances coming in contact with the flowing water. Several important reports and opinions in favour of the dust-absorbing properties of this apparatus, as applicable to mines and tunnels, have been received from eminent scientific men, besides several technical newspaper notices to the same effect. Now, although this patented apparatus cannot be used as a ventilator for pumping out vitiated air from enclosed spaces in ships, it will doubtless be productive of very appreciable advantages when a power ventilator is not used (like that patented by Captain Norton), inasmuch as the Stanley invention will not only absorb far more floating particles than automatic ventilators, however excellent, can extract, but will be more efficient than they can be in cooling the receptacles ventilated, the air of which is intended to be purified. Hence, in tropical climates, and in cabins containing individuals who are affected with contagious and other diseases, and numerous bodily injuries from which there are many a large quantity of dangerous emanations, the adoption of Stanley's patent system will be particularly appreciable and beneficial.

Our estimation of this ingenious apparatus is also likely to be enhanced by a consideration of the defective sanitary appliances which are in use upon an overwhelming majority of even our best steam ships of the mercantile marine, and which are ably commented upon in a leading article in the *British Medical Journal* of the 13th of last January, upon the subject of the medical and sanitary departments of ocean steamships. According to our contemporary, "For days, sometimes weeks, together, multitudes of men, women, and children are assembled within the narrowest possible compass, and with them are crowded cargoes of various kinds, stores, cooking arrangements, water-closets, and other necessities for 1,500 to 2,000 persons. . . . It is, therefore, with some surprise that we learn that 'few,' if any, ships are furnished with proper ventilating apparatus, or other sanitary appliances, that the newest Atlantic vessels are still dependent upon the antiquated bell ventilator, which is frequently almost useless when most required—during heavy weather; and that no effort has yet been made to apply to these steamers the more effective systems of fan and tube ventilation, or any of the modern devices for purifying the air and maintaining an equable and healthy temperature. We hear, too, of old-fashioned water closets, which constantly smell, and are frequently neglected throughout the voyage; of foul gases from the bilge being conducted by scupper pipes into the sleeping compartments of passengers; of basins communicating with offensive receiving pipes and water closets." A correspondent has stated "that the most healthy individual embarking at Liverpool for America is probably a hundred times more likely to lose his life in transit by disease than by shipwreck." The *British Medical Journal* has very forcibly pointed out, by strong and irrefutable arguments, the advisability of the Government undertaking the formation and control of a marine medical service. We trust that this recommendation will soon be carried out, not only by our own Government but also by that of other nations; and then, no doubt, very great improvements will be effected in ship ventilation in the interests of the health of the passengers. We think it essentially desirable also that better means will be provided for the due superintendence and control concerning the ventilation of other parts of ships, as coal bunkers, coal and cargo holds, cattle receptacles, &c., which ship surgeons or medical men may not be competent to properly inspect and control.

In concluding our remarks upon the ventilation of ships, we trust that the facts and statements we have made will cause this subject to be more fully discussed and appreciated than it unfortunately has been, and that within a short period hence, this leading naval sanitary requirement will be generally and satisfactorily adopted.

THE GEOMETRY OF THE SLIDE AND EXPANSION VALVES.

II.

In our last article we showed a geometrical method of representing the position of the slide valve in a steam engine corresponding to any position of the crank, and gave in detail the particulars of this method applied to the case of an ordinary single ported slide valve, as usually fitted on small engines. The same diagram serves also for a double-ported valve, the lap of a double-ported valve being the same for each of the ports at either end of the cylinder.

We now proceed to show the same principle extended to expansion valves, considering, first, the cases of valves working over *fixed* faces, and afterwards those of valves working on *moveable* faces, which are usually the backs of other slide valves.

The first kind of valve we shall consider consists of several bars parallel to each other, the face having several ports, also parallel, at a distance apart equal to that between the bars of the valve. In dealing with this kind of valve two cases present themselves. First, the case in which, when the valve is at the centre of its motion, the bars are immediately over and cover the ports; and, second, that in which the valves, when at the centre of their travel, leave the ports fully *open*. A valve of the first description is shown in section, in Fig. 6, and one of the second kind in Fig. 7, both valves being shown in the positions they occupy when in the centre of their travel. It will be seen that in the first, the number of bars in the valve is the same as the number of ports in the valve face; while in the second, there must necessarily be one more bar in the valve than ports in the valve face.

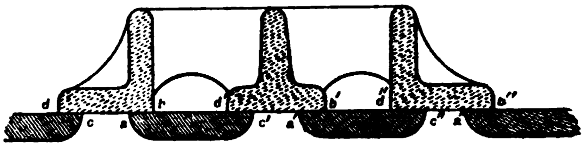


Fig.6.

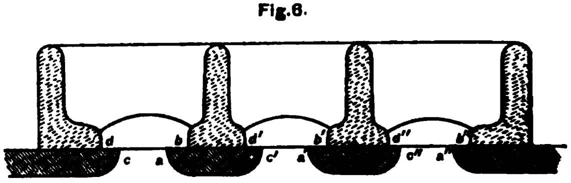


Fig.7.

In both of these descriptions of valve the eccentrics which move them may be set at any angle of advance, and the corresponding motion of the valve may be made available for admitting and cutting off the steam; but in order that the valves may be suitable for the engine going either ahead or astern, the angle of advance of the eccentric in the case of the first kind of valve is usually made 90°, while in the second kind the eccentric generally has no angular advance; these positions of the eccentric giving the same motion to the valve relatively to the piston, whether the engines are going ahead or astern.

When the valve shown in Fig. 6 is in the middle of its travel, we see that if it is moved a distance *a b* to the left, it will commence to uncover the ports ; or if it is moved a distance *c d* to the right, it will also uncover the same ports.

Applying the diagram described in the last article to this valve, we obtain Fig. 8. In this diagram C T and C B are each half the travel of the valve, and the circles described on them represent the distances of the valve from the centre of its travel at any position of the crank. The centres of these circles lie, in this case, on the line of centres of the crank, because the angle of advance of the eccentric is 90°. If now with centre C, and radius equal to *a b*, we describe the circle A D, cutting the left-hand valve circle in A and D, and from the same centre with radius equal to *c d* we describe the circle E F, cutting the right-hand valve circle in E and F, we see that when the crank is in the position C E, the valve, having travelled a distance equal to *c d*, is on the point of opening the ports, and that while the crank is in any position C P, intermediate to C E or C F, each port will be open a distance, G P. When the crank is at C F the ports will just close, and will remain closed until the crank arrives at C A, when they again open, and remain open until the crank comes to the position C D, from which position to C E they are closed.

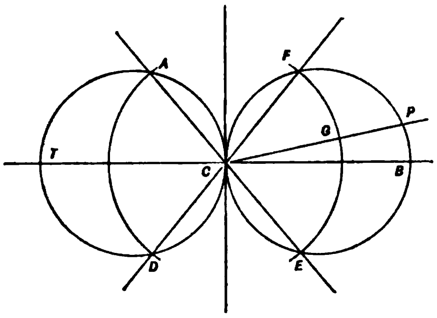


Fig. 8.

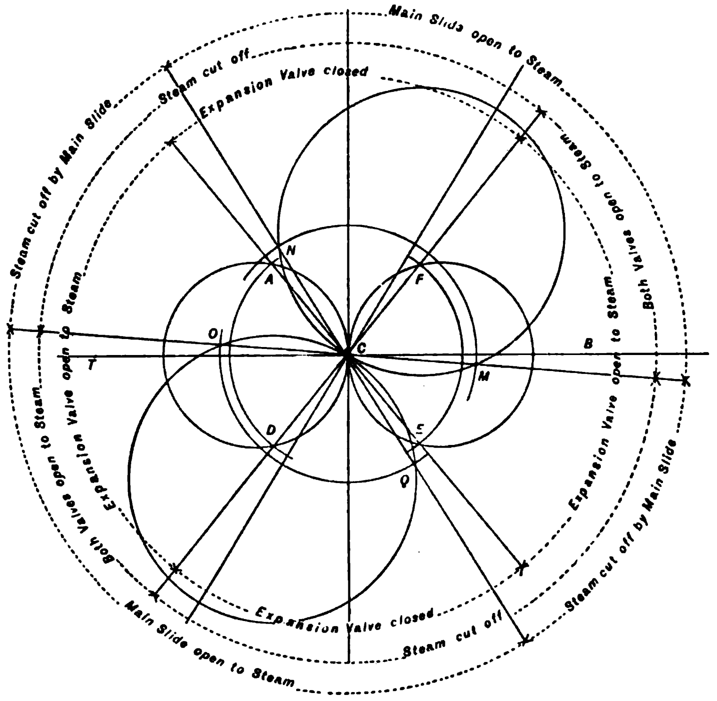

Main Slide open to Steam
Steam cut off
Expansion Valve closed
Steam cut off by Main Slide
Both Valves open to Steam
N
A
F
O
C
B
T
M
D
E
Q
Both Valves open to Steam
Expansion Valve open to Steam
Expansion Valve open to Steam
Steam cut off by Main Slide
Expansion Valve closed
Steam cut off
Main Slide open to Steam

Fig. 9.

With this form of expansion-valve, and also with that shown in Fig. 7, an ordinary single or double-ported slide valve must be used in addition ; the slide valve and expansion valve are each used in admitting steam *to* the cylinder, but the slide valve alone is used in exhausting the steam *from* the cylinder. If we combine the diagram showing the action of the expansion valve, as in Fig. 8, with that showing the action of the slide valve, as in Fig. 3 of the last article, we obtain at once a representation of the whole of the motions of the two valves affecting the admission of the steam. This has been done in Fig. 9, the letters representing the critical points of the diagram being the same in this diagram as in Figs. 3 and 8.

From this diagram we see that when the crank is in the position C E, the piston having nearly completed the downward stroke, the expansion valve commences to open ; but, as the main slide is then closed, no steam can enter the cylinder. When the crank has reached the position C M, close to the bottom centre, the main slide opens to steam, and, as the expansion valve ports are then also open, steam can enter the cylinder. When the crank arrives at the position C F, the piston then having performed part of the upstroke, the expansion valve closes its ports and shuts off the steam ; but the main slide is still open, and remains open until the crank reaches the position C N. When the crank comes to C A the expansion valve again opens, but, the main slide being closed, no steam can pass into the cylinder until the crank has turned into the position C O, when, owing to the opening of the main valve, steam again enters the cylinder, and both valves remain open during the first part of the down stroke, until the crank arrives at the position C D, when the expansion valve again closes, cutting off the steam, the main slide valve closing at the position C Q of the crank. The expansion valve is again opened when the crank arrives at the position C E, and the operations above enumerated are repeated during each revolution of the engine.

An inspection of Fig. 9, shows clearly one precaution which must be taken in designing valves of this kind. It is necessary that the expansion valve should not open to steam before the main slide closes the cylinder port, for otherwise a double admission of steam at each stroke would ensue, leading to the consumption of as much steam per stroke as the use of the main slide by itself would have necessitated, while the work done by this steam, owing to the partial interruption of the supply, would be less ; such an expansion valve would, therefore, be a decided disadvantage, instead of being the means of effecting economy of steam.

For instance, if the lap *a b* or *c d* (Fig. 6) of the expansion valve were slightly less, so as to have brought the positions C A or C E of the crank farther from the line of centres than C N or C Q, this double admission wonld take place. Or if the lap of the main slide, or the angular advance of its eccentric were less, so as to give a later cut off, the same result would ensue. We shall have occasion to remark further on this subject when giving the geometry of the means adopted, both with ordinary slide valves and with the different kinds of expansion valves, in order to produce a *variable* cut off.

If the expansion valve is like that shown in Fig. 7, when at the centre of its stroke, its eccentric will be fitted with no angular advance. We see that the valve will require to be moved a distance equal to *b c* to the left, or a distance *a d* to the right, in order to cut off the steam ; while we further see that if it is moved the distances *a d'*, *b c'* in these directions, the valve will again unconver the steam ports, giving another admission of steam unsuitable for the proper working of the engines. In order, therefore, to prevent this from occurring in these valves, the distances *a d'*, *b c'* must each be made greater than the half travel of the valve. Precautions in a similar direction must also be taken in designing valves of the kind shown in Fig. 6.

In Fig. 10 are shown the valve circles, &c., for this form of valve.

There being no angular advance of the eccentric, the centres of these circles lie upon the line at right angles to T B, the line of centres of the crank; and, as before, the diameter of these circles is equal to half of the travel of the valve. With C as centre describe the arcs of circles A F P and D E, having radii equal to *a d* and *b c* respectively. Then C F, C A, C D, and C E, drawn from the points of intersection of these circles with the valve circles to the centre C, are the positions of the *crank* when the valve just closes the ports in the valve seat.

If we take any intermediate position C P of the crank, this line cutting the valve circle in G, we see that the corresponding position of the valve is at a distance C G from the centre of its motion; and, accordingly, since it must move a distance C P, equal to *a d*, from the centre to completely close the ports, the distance G P must represent the amount of each port opening corresponding to the position C P of the crank.

Following the motion of the crank from the bottom centre, at which the valve is full open, we see that when the crank is at C F the valve closes, it opens again when the crank is at C A, closes on the down stroke of the piston when the crank reaches the position C D, again opening when the position C E of the crank is attained.

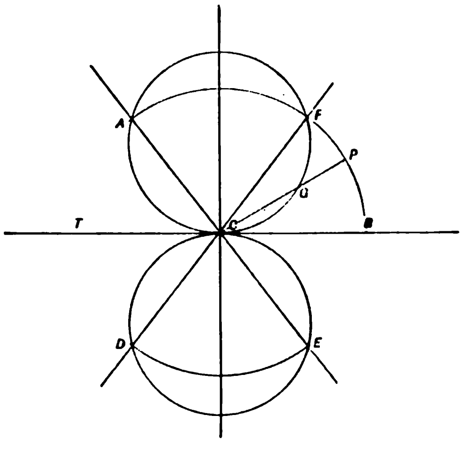


Fig.10.

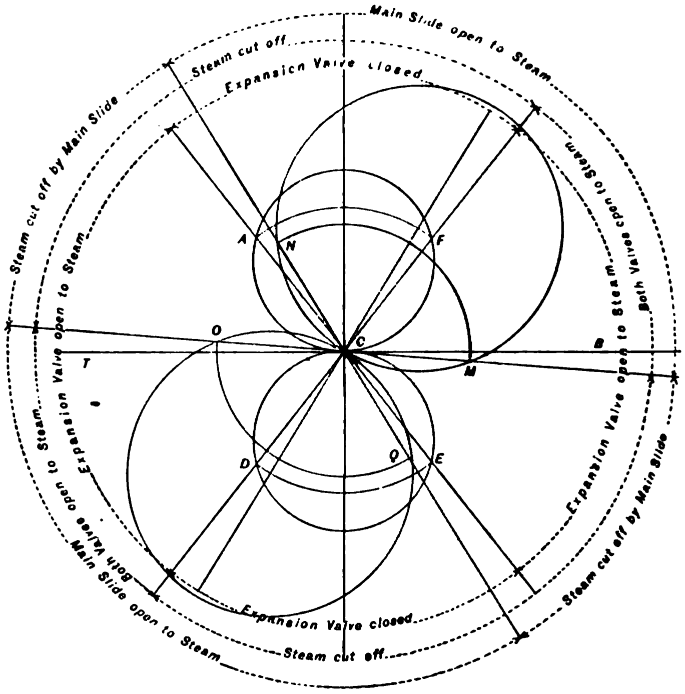

Main Slide open to Steam
Steam cut off
Expansion Valve closed
Steam cut off by Main Slide
Expansion Valve open to Steam
Both Valves open to Steam
A
N
F
O
C
B
T
M
D
Q
E
Expansion Valve open to Steam
Both Valves open to Steam
Main Slide open to Steam
Expansion Valve closed
Steam cut off
Expansion Valve open to Steam
Steam cut off by Main Slide

Fig.11.

If we now superimpose this expansion valve diagram upon that of the main valve, as we did in the case of the previous expansion valve, we obtain Fig. 11, the letters representing the critical points in this Fig. remaining the same as in Figs. 10 and 3.

We see at once from this Fig. that, for positions of the crank lying between C M and C F, and also between C O and C D, both the main slide and expansion valves are open to steam; while, in the positions of the crank ranging between C F and C O on the down stroke, and C D and C M on the up stroke, either one or both of these valves are closed to steam, and thus prevent its entering the cylinder.

From this diagram, as well as from Fig. 9, we see the condition necessary in order to prevent the expansion valve opening to steam before the main slide has fully closed; viz., that the lap of slide valve and the distance *a d* of the expansion valve, must be so chosen that the position of C N comes before that of C A, and similarly for the down stroke, the laps, etc., must be such that C Q comes before C E.

Expansion valves of this kind were very largely used in the early types of marine engines in which a total expansion of not more than four times was employed; but, as they necessitated separate valve seats being fitted for them, between the main slide valve and the steam pipes, and as the main slides themselves required a considerable space in which to work, a portion of the expansion (that taking place between the closing of the expansion valve and that of the main valve,) occurred in the slide valve chest as well as in the cylinder, and the whole gain due to expansion was not realised. This has led to the introduction, and the now very general use, of expansion valves working direct on the back of the main slides, diagrams representing which we propose giving in a future article.

(*To be continued.*)

Review.

Tweddell's System of Hydraulic Rivetting.

The idea of applying steam and hydraulic machinery to the purposes of rivetting, originated mainly from the growing and unjust demands of the men employed to carry out this class of work by hand. It is well known in the marine world that on the introduction of iron for shipbuilding, the shipwright of the day who had faithfully served a seven years' apprenticeship, and fitted himself to carry out any professional mechanical work in shipbuilding, rebelled at the idea of undertaking the task to work on iron. On account of this, any men who could handle a hammer, or lift and carry plates and frames, were engaged as iron shipbuilders. In this manner, tinkers, gardeners, costermongers, navvies, &c., worked themselves into different shipbuilding-yards, and styled themselves iron shipbuilders.

From the time of the commencement of their organization they have combined in a society, and by depending on the support of this society when out of work, they have been in the habit of striking for most exorbitant wages. As before stated, the inconvenience and loss sustained by employers owing to these continual strikes, led to the introduction of rivetting machines, and it has been undoubtedly proved that the rivetting tinker of our iron shipbuilding-yards with his strikes, high wages, and ill kept time, can be dispensed with, as a simple machine can do his work. The following quotation from a well known Society pamphlet, which is headed "Rivetting Machines in Shipyards," proves by their own words what they have brought on themselves.

"For some time past the serious attention of the Executive Council has been directed to the rapid increase of rivetting machines in shipyards, for they know well that this introduction and somewhat alarming increase of machine-rivetting must have a pernicious effect upon the manual labour of our members engaged in this department of iron shipbuilding. Our past experience teaches us that, wherever hand labour and machine labour come into competition, wages will inevitably be reduced, and mere physical strength must in course of time succumb. This logical sequence has been proved over and over again in numberless instances, and with many other trades than ours. What has occurred in other branches of industry must, with unerring certainty, be repeated in our case. The Council, therefore, deemed it prudent to obtain information upon this vital subject, and place it before the members, with a few words of prudent advice—for upon our own heads lies the blame of this introduction of machinery into the trade, first, by losing time unnecessarily, and thus keeping the work behind. It should be clearly impressed upon the members' minds that the work must be executed—if not by us, by others, or by machinery—where the workmen, through losing time, retards the completion of their employers' contracts. Steamships and sailing vessels are an essential requisite of trade, of commerce, and of human progress in this age, and they must be supplied. Ships must be built by some agency, and will be whether we assist in their construction or not. This is one chief cause of rivetting machines being so largely in use in some districts. Another evil that has assisted in their development is, the inordinate demands made upon employers for higher piece-work prices. We know of instances, on the Clyde, where an advance of 50, and even 100, per cent. has been given upon some portions of rivetting, and still the rivetters renew their unjust demands for higher rates, complaining that the jobs will not pay. What this week is a good price, next week is utterly inadequate, and more and more money is demanded, until the firms—at their wits' end—will engage any labour but ours to complete the work. Hence machines are invented to supplant our labour. We find, in our inquiry, that the increase of machines has in most districts been in proportion to the unreasonable demands of our members. Where our members are the most insatiable and unjust in their actions, so are the employers straining every nerve to carry on their work without our services; and, unless some beneficial change takes place in our conduct, they will eventually accomplish their object."

The Society organ then goes on to show how much cheaper the rivetting is carried out by machinery than by hand.

The introduction of machine rivetting dates back about seventeen, years but it has only been introduced to any extent during the last three or four years. Foremost in point of excellence amongst the different systems, "Tweddell's Hydraulic Rivetting Machinery" is in the greatest demand, and its general adoption appears to be limited to a very short space of time.

Already the majority of our Clyde shipyards—including all the larger ones—are furnished with Tweddell's hydraulic rivetting machines and plant, overtaking work, constantly, efficiently, and with greatly reduced cost. The prime cost of furnishing a complete hydraulic rivetting plant, is of course, considerable, and at present prevents its more general adoption, but economic builders will soon discover that the first outlay would be recouped in a short space of time.

The yards in which this system has received perhaps the largest amount of attention and practical development are:—Messrs. A. M'Millan & Sons, Dumbarton; Messrs. J. & G. Thomson, Clydebank; Messrs. J. Elder & Co., Fairfield.

In one or two of the yards named, the practice has been applied to features which in others are still accomplished in the ordinary way. Neither expense or trouble, however, are spared in several of the yards to extend the practice into every feature where rivetted work is needed. It may although be fairly said that these hydraulic rivetters have virtually supplanted manual rivetting in nine-tenths of the structural requirements of a vessel.

Messrs. M'Millan, of Dumbarton, were the pioneers in developing machine rivetting, and they have up to the present taken the lead in increasing its application in every possible direction.

In their yard can be seen portable rivetters suspended over a vessel's deck between 40 and 50 ft. above ground, capable of reaching and clenching rivets in stringer plates at a distance of 4 ft. 6 in. from edge of plate. The power brought into play in closing some of these rivets is very great, from 20 to 30 tons, and yet this is conveyed by a small tube of only ½ in. outside diameter, and in some cases through a distance of many hundred feet. The portable rivetter here indicated is suspended on a light and handy carriage, which can traverse the upper deck from stem to stern, being made purposely low, so as to clear poop and bridge deck beams, if such should be fitted. With this machine, Messrs. M'Millan have closed from 400 to 480 rivets per day of 9 hours, in stringers 3 ft. 6 in. wide. They have also effected some very heavy work in attaching the sheer strake to the gunwale bar, the rate of progress being correspondingly satisfactory. This we should mention was carried out by Mr. Tweddell's system, and the same features in the s.s. *Alaska*, recently completed by Messrs. J. Elder & Co., were as satisfactorily operated upon by another of Mr. Tweddell's rivetters.

In rivetting beams this machinery has been known to close from 1,800 to 1,900 rivets per day of 9½ hours, and in frames about 1,400 rivets per day.

In keel rivetting as many as 420, 1¼ in. rivets per day have been put in by the class of machine used for this purpose, an amount which is fully equal to the work of two squads of rivetters, and in one yard 70 rivets were closed in 70 consecutive minutes.

Mr. Tweddell and his co-patentees, Messrs. Fielding & Platt, of Gloucester, can fairly claim that they have not only improved the character of the work in ship construction, but they have relieved the shipyard artizan from a species of work which requires little or no skill in its execution, work, indeed, which may properly be relegated to, as it certainly will in course of time be included in, that vast domain in which water, steam, electricity, and the other natural powers are so wondrously made to play their part. It is clearly, then, to the interests of shipbuilders to give this system every chance, thereby placing themselves in a more independent position in respect to labour, as clearly as it is the duty of workmen to consider soundly their position and prospects in view of all that is transpiring in their very midst.

Torpedo Trials in the Bosphorus.—The much talked-of torpedo trial in the Bosphorus took place recently. The Sultan had fixed 12 o'clock as the hour, and the passage between Seraglio Point and the Scutari shore as the locality, in order that he might have the opportunity of watching the proceedings from Yildiz Kiosk. Early in the morning a small tug-boat with a long cigar-shaped instrument slung to her side, took up a station close under Seraglio Point, and shortly afterwards two men-of-war boats anchored near Leander's Tower on the opposite side of the Bosphorus. The distance between these boats was between 80 and 100 feet, and this open space represented the enemy's vessel against which the torpedo would operate. The two boats were anchored in the full strength of the current, three-quarters of a mile from the steamer. The water was anything but smooth, as the southerly wind meeting the force of the stream caused a considerable sea, which materially affected the course of the current, so that the conditions were by no means favourable for the coming trial. Punctually at noon the torpedo was launched. Two rods alone were visible above the water, being indicators by which the course of the torpedo is detected. The machine made almost a direct course for the boats, in spite of the wind, sea, and varying current through which it had to pass. It was evidently under perfect control. Passing between the two target boats it ran some distance further, then turned and came back again. Various manœuvres were then practised, the sight-rods were raised and lowered, the machinery stopped and started, the torpedo turned to the right or left as desired by the committee. The only indication of the torpedo's course through the sea was a little ruffle of the water above the screw. The torpedo is about 26 feet long and 24 inches in diameter. The motive power is carbonic acid gas. She carries a charge of about 100 lbs. of gun cotton, and the whole of the manipulations are effected by electric currents sent from the operating station. The Minister of Marine, with Hobart Pasha, directed the trials, immediately after the conclusion of which the Minister hurried off to report the result. A large number of spectators watched the proceeding from a special steamer, and among them were several members of the diplomatic corps and all the military and naval attaches. The general conclusion was that the trial was most successful, that Colonel Lay had fully demonstrated the possibility of manœuvring the weapon of which he is the inventor with great rapidity and accuracy under all circumstances.

A New Steamer for the Yenisei.—Captain Johannesen, who commanded the steamer *Lena* on the Vega expedition, has arrived at Motala, to negotiate for and superintend the building at the works there of a screw-steamer of about 100 tons, to be built of Swedish Bessemer steel, to trade on the river Yenisei. She is to be delivered early next year, and will be the largest steamer on that river. The vessel is built to the order of M. Sibiriakoff, the well-known Russian merchant.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Buninyong.—On January 23 the new s.s. *Buninyong* was successfully launched from Messrs. Caird, Purdie & Co.'s ship-yard. The new steamer has been built for Messrs. W. Howard Smith & Sons, London and Melbourne, and has a considerable amount of room for passenger accommodation as well as cargo. The *Buninyong* is 280 ft. between perpendiculars; 38 ft. beam; 20 ft. depth of hold, and is classed 100 A 1. She is built of steel, and her gross tonnage is 1900. She is to be fitted up with engines of the most improved type, which will be supplied by Messrs. Jack & Co. Liverpool. At the launch, the vessel was gaily decorated with streamers, and the ceremony of christening was performed by Miss Smith, a youthful daughter of the owner. The launch was in all respects most successful, and amongst the numerous assemblage who witnessed it were Messrs. Caird and Purdie (builders); Mr. Thos. Massicks, Millom; Mr. Howard Smith, Captain Stanford, Mr. Lawrence (Lloyd's surveyor), Mrs. Caird and party, Dr. Murray, Dr. and Mrs. Sinclair, Mr. E. Lawson-Barnes (manager Lancaster Bank), &c., &c.

Hilda—On January 25 a smack was launched from the building-yard of the Whitby & Robin Hood's Shipbuilding & Graving Docks Company. The dimensions are as follows:—Length of keel, 70 ft.; extreme breadth, 19 ft. 9 in.; length between perpendiculars, 76 ft.; length over all, 81 ft. 6 in. The smack was christened *Hilda* by Miss Miller, daughter of Mr. Miller, the managing owner, and makes the third vessel of the class belonging to a local company.

Accornac.—On January 25 Messrs. M. Pearse & Co. launched from their yard at Stockton-on-Tees the steamer, *Accornac*, built to the order of Messrs. W. Tapscott & Co., of Liverpool. The vessel is classed 100 A 1 at Lloyd's, and under the personal superintendence of Mr. Fred. J. Pilcher, Consulting Engineer of Liverpool and London. Her dimensions are:—Length, 300 ft.; breadth, 39 ft., and depth of hold, 26 ft. 6 in., and is capable of carrying 3,300 tons, with water ballast in double bottom, built on the cellular system, and has all the latest improvements. She will be fitted with a pair of engines 230 horse power, by Messrs. Blair & Co., of Stockton-on-Tees.

Sara.—On January 25 Messrs. Edwd. Withy & Co. launched from Middleton Shipyard, West Hartlepool, a large iron screw steamer, built to the order of Messrs. Jos. F. Cohen & Co., of London and Cardiff. The vessel is No. 116 in the Builders' book; her principal dimensions are:—Length, B. P., 257 ft. 6 in.; beam extreme, 34 ft. 6 in.; depth moulded, 20 ft. 4½ in., and her deadweight carrying capacity will be about 2,350 tons. She has topgallant forecastle, long bridge house, quarter deck, and full poop, and double bottom for water ballast under both holds. The decks, bulwarks, rails and chart house, as also the skylights and companions are of iron; she will be fitted with four steam winches, Messrs. Amos & Smith's steam steering gear, donkey boiler and patent windlass, and will be rigged as a double topsail schooner. She has been built under Lloyd's special survey for the 100 A 1 class and under the personal superintendence of Messrs. Menzies & Blagburn, of Newcastle. Engines of 130 nominal horse power will be fitted by Messrs. T. Clark & Co., Elswick. On leaving the ways the vessel was named *Sara* by Miss Blanche Cohen, niece of Mr. Jos. F. Cohen.

Wellington.—On January 27 there was launched from the shipbuilding yard of Sir W. G. Armstrong, Mitchell & Co., Low Walker, an iron screw steamer of a special description. The vessel was named the *Wellington*, and is built to the order of Sir Robert Dunsmuir and W. N. Diggle, Esq., who have extensive coal mines in British Columbia, and the steamer is for the purpose of carrying the produce to San Francisco and other parts of the Pacific coast. The *Wellington* is a vessel of 2,700 tons burthen. She is built with a view of being able to carry and work a large cargo in the quickest and most economical manner, and her arrangements in this respect are very complete; and, seeing that she will have to make the return voyage in ballast, she is made to carry an exceptionally large quantity, so that the vessel may be well immersed. Her engines, which are on the compound surface-condensing principle, with all the latest improvements for economy of fuel, have been built by the Wallsend Slipway and Engineering Company (Limited). They will indicate 950-horse power, and will give the vessel a speed when loaded of 10 knots.

Edith.—On February 6 there was launched from the iron shipbuilding establishment of Messrs. Harkess & Son, East Slipway, Middlesbrough, an iron screw steamer of the following dimensions:—Length, 251 ft.; breadth, 34 ft. 8½ in.; depth, moulded, 18 ft. 1 in. She is built on the raised quarter-deck system, has long bridge, and topgallant forecastle for the accommodation of crew, &c. The saloon, state rooms, captain's cabins, &c., are fitted under the bridge at fore-end, with accommodation for officers and engineers at after end of bridge. The main quarter and bridge decks, charthouse, and engine-room skylight are all of iron. She has been built under special survey, and will be classed 100 A 1 at Lloyd's. She is fitted with all the latest improvements, including swinging anchor crane on topgallant forecastle for lifting anchors, &c., Harfield's patent windlass, and three powerful steam winches, and large hatchways for the quick loading and discharging of cargo. The vessel will be fitted with two steel boilers, and a pair of compound surface condensing engines, 120 nominal horse-power, with cylinders 28½ in. and 55 in. diameter, manufactured by the Northern Marine Engineering Company, Gateshead-on-Tyne. She will carry about 1,900 tons of cargo, will be rigged as a two-masted topsail schooner, and has been specially designed for the Black Sea and Mediterranean trade, with water ballast under both holds and in after peak. She is built to the order of W. Harkess, Esq., of Middlesbrough, the senior partner of the firm, and will be commanded by Capt. Sellers. On leaving the ways the vessel was christened the *Edith* by Miss Williams, of Clifton, Bristol.

St. Joseph.—On February 7 there was launched from the shipbuilding-yard of Messrs. Kish, Boolds & Co., Sunderland, a screw steamer, built to the order of Messrs. Dussarget, Bonnin & Badille, of Bordeaux. She is of the following description:—220 ft. long, 31 ft. 6 in. broad, and 14 ft. 6 in. deep, having long raised quarter-deck, bridge, and top-gallant forecastle, double bottom built on the continuous cellular system, capable of carrying about 250 tons of water ballast, and is to receive the highest class in Bereau Veritas Registry. She is supplied with Higginson's patent steam quartermaster, Emerson and Walker's patent windlass; also large donkey boiler and powerful steam winches by Messrs. Welford Brothers, of Pallion. Mons. Badille (one of the owners) has personally superintended the building of the vessel, assisted by his engineer, Mons. Brun. The vessel was named the *St. Joseph* by Madame Brault, wife of Mons. Brault, the French Consul at Sunderland. After the launch the vessel was towed to the South Dock, where she is to receive her machinery from Messrs. Carr & Co., of Sunderland.

Ackworth.—On February 8 W. Gray & Co. launched from their yard, at West Hartlepool, an iron screw steamer of the following dimensions:—272 ft. by 35 ft. 6 in. by 20 ft. Classed 100 A 1 at Lloyd's, and built to the order of Messrs. Joseph Merryweather & Co., West Hartlepool. The vessel is intended for the Indian and general trade, to carry about 2,600 tons dead weight. She is of the well-decked type, having raised quarter-deck to engine-room, and bridge before it, also a topgallant forecastle for crew, and double bottom for water-ballast in each hold, patent windlass, and four steam winches. The engines, of 100 horse power, are being supplied by Messrs. T. Richardson & Sons, of Hartlepool. On leaving the ways the christening ceremony was performed by Miss Whatley, the vessel being named *Ackworth*.

Tourmaline.—On February 8 there was launched from Messrs. Richardson, Duck & Co.'s South Stockton iron shipyard an iron screw steamer of the following dimensions:—Length over all, 286 ft.; length between perpendiculars, 277 ft.; breadth, extreme, 36 ft.; depth in hold, 24 ft. 6 in. Gross register tonnage, about 2,100 tons. This steamer has been built to the order of Messrs. C. O. Young & Christies, of Cardiff, and is classed 100 A 1 at Lloyd's, special survey, but her scantlings are in several respects considerably in excess of Lloyd's requirements. She is built on the three-decked rule, the main and upper decks being laid of iron throughout; the greater part of the upper deck is, in addition, covered with yellow pine, leaving a wide waterway at each side. The 'tween decks are fitted with permanent iron shifting boards. The vessel has a double bottom in after hold and under boiler for water ballast, and also a deep tank forward of the engine-room. She has a full poop aft, with accommodation for captain, officers, &c.; an iron house amidships for the engineers, and a topgallant forecastle. She will be supplied with five double-cylinder steam winches, and Harfield's patent windlass. The engines, 160 horse-power, are by Messrs. Thomas Richardson & Sons, Hartlepool, compound direct acting cylinders, 34 in. and 36 in., stroke 36 in., pressure of steam 30 lbs. She will be rigged as a brigantine, and is specially designed for the Atlantic and grain-carrying trade. As the vessel was leaning the ways she was christened the *Tourmaline* by Mrs. Corfield, wife of Captain Corfield, who has superintended the building of the vessel, and will take the command.

H.M.S. *Wanderer.*—On Thursday afternoon (8th ult.) there was launched from the yard of Messrs. Raylton, Dixon & Co., H.M.S. *Wanderer*, the second of the two gunboats building at Cleveland Dockyard for H.M. Navy. The *Wanderer* has been built under the superintendence of Mr. Allen, Admiralty Overseer, assisted by Mr. Adams, and has a displacement of 1,000 tons. She is built on composite principles, having iron frames, steel bulkheads and flats, and the shell consists of two thicknesses of teak—three inches each—copper fastened and screw bolted to the frames. Her stern and keel are of English oak, while her bottom is covered with copper up to the water line. The lining of the poop, cabins, and all the bulwarks are of thin steel plates, instead of wood, to prevent splinters. She is to be fitted with direct acting horizontal engines of 750 indicated horse-power, by Messrs. R. & W. Hawthorn, of Newcastle. Her armament, when complete, will consist of two 6-in. breechloading guns, placed in the forecastle and poop, for chase guns, and two broadside breechloaders of 5-in. bore, one 7-pounder boat gun, and two Gardner guns, which are somewhat similar to the well-known Gatling guns. The arrangements for launching, on this occasion, were made without any ceremony or public notice, but the usual form of service at the launching of Government vessels was performed by the Rev. J. K. Bealey, Vicar of Middlesbro', and the lines which held the dog-shores and christening bottle were severed by Miss Dixon, daughter of the builder, who, in doing so, wished success to H.M.S. *Wanderer*.

Pione.—On February 8, Messrs. Short Bros. launched at Pallion, Sunderland, a screw steamer, built to the order of Mr. J. Sinclair, of Seaham Harbour, of the following dimensions:—Length, 160 ft.; breadth, 25 ft.; and 12 ft. 3 in. depth of hold. She is constructed to Lloyd's 100 A 1 class, under special survey, and has a long raised quarter-deck, extending over engines and boiler, and bridge-house for accommodation of captain and officers, and topgallant forecastle for crew; she has water ballast in after hold and both peaks, three large hatchways, and two steam winches and donkey boiler, Harfield's patent windlass to work by steam winch, and all the decks are of iron, except bridge. On leaving the ways, the vessel was named the *Pione*, the ceremony of chistening being performed by Miss Elliot, of Seaham.

Hartside.—On February 8 Messrs. D. Baxter & Co. launched from their yard at Monkwearmouth a screw steamer, built to the order of Messrs. Charlton, M'Allum & Co., Newcastle. The steamer was named the *Hartside*, by Mrs. William Richardson. The vessel is 185 ft. long, 29 ft. broad, and 13 ft. 10½ in. deep; and is expected to carry 900 tons of cargo on a mean draught of 12 ft. 3 in. of water, and an average speed of nine and a half knots when laden. The engines will be constructed by Messrs. R. & W. Hawthorn, of Newcastle, and will have cylinders 25 by 48 by 30 stroke. The boilers will be of steel, of an extra large size, and a working pressure of 80 lbs.; three large furnaces will have a heating surface of 1,800 sq. ft., and will be adapted for the consumption of small coals. The steamer's decks are of iron, she is fitted to carry water ballast, and among other improved apparatus she will have three steam winches, which will rapidly discharge the cargo.

Crown of England.—On February 9 Messrs. R. Williamson & Son, Workington, launched from their shipbuilding-yard an iron sailing-ship, built to the order of Messrs. Robertson, Cruikshank & Co., of Liverpool. Her dimensions are:—Length, 267 ft.; breadth, 39 ft.; depth, 23 ft. 7 in.; and will register 1,800 tons nett. The vessel has been constructed in excess of Lloyd's requirements, and under special survey, and has been specially fitted out for the Calcutta and San Francisco trades. As she left the ways she was named *Crown of England* by Miss Jenny S. Robin, of Glasgow. The *Crown of England* will sail for Calcutta in the beginning of March, under the command of Captain Jackman.

Erato.—On February 10 William Gray & Co. launched from the yard at West Hartlepool an iron screw steamer of the following dimensions:—262 ft. by 34 ft. 6 in. by 19 ft. 8 in. She has been built to the order of Messrs. Gladstone & Cornforth, West Hartlepool, to carry 2,350 tons deadweight. The vessel is built to the highest class in Lloyd's, and has long raised quarter-deck, and bridge house, also long topgallant forecastle extending to foremast, and double bottom for water ballast in both holds. The engines, which are 150 horse-power, are being supplied by Messrs. Blair & Co. (Limited), Stockton. The christening ceremony was performed by Miss Cornforth, the vessel being named *Erato*.

Yorouba.—On February 10 was launched from the Barrow Shipbuilding Company's Yard a schooner-rigged iron screw steamer, built to the order of Messrs. Verminck et Cie., of Marseilles. Her dimensions are:—Length, between perpendiculars, 270 ft.; breadth, moulded, 35 ft. 9 in.; depth in hold 23 ft. Her gross tonnage is 1,900 tons, and she is built to the highest class in Lloyd's. She is fitted with a poop aft, containing accommodation for 25 first-class passengers. The ship has steam windlass, steam stearing gear, and four steam winches. She has compound direct-acting surface-condensing engines of 175 nominal horse-power, with cylinders of 36 in. and 63 in. diameter, and 48 in. length of stroke, the working pressure being 75 lbs. She has two boilers 12 ft. in diameter and 15 ft. long, and eight furnaces 3 ft. 9 in. diameter.

Tynemouth.—On February 24 Messrs. Robert Thompson & Sons launched at their Southwick Yard, Sunderland, an iron screw steamer of the following dimensions:—Length, 286 ft.; breadth, 37 ft.; depth, 24½ ft.; built to the order of T. H. Dawson, Esq., of Newcastle-on-Tyne, on the three decked rule, under Lloyd's special survey, for the highest class, under the personal superintendence of Captain Tate. She has topgallant forecastle fitted up for crew and firemen; bridge-house amidships for the accommodation of officers and engineers; short full poop aft, fitted up in good style, for captain's room, with spare staterooms; has water ballast in both holds; four hatchways; four steam winches, and donkey boiler, by Messrs. Clarke, Chapman & Co.; Harfield's patent windlass; stearing gear amidships; screw gear aft, &c., &c. She will be fitted with engines of 180 nominal-power, by Messrs. Clarke & Co., Elswick, Newcastle. As the vessel left the ways she was gracefully christened the *Tynemouth* by Miss H. Chaytor, of Claervaux Castle, after which a large number of ladies and gentlemen adjourned to the offices of the builders, amongst whom we noticed Mr. and Mrs. Dawson, Captain and Mrs. Stevenson, Captain and Mrs. Tate, Mr. and Mrs. Wright, Mrs. Drewett, Miss H. Claytor, Miss Scott, Captain Battey, Captain McGregor, Mr. Cuthbertson, &c.

ERRATUM.

Dorothy, built for Mr. H. Champness, should read Mr. H. Champion, and the dimensions are:—Length of keel, 57 ft.; breadth of beam, 18 ft.; tonnage, 44 tons.

LAUNCHES.—SCOTCH.

Shandon.—On January 22 there was launched from the shipbuilding yard of Messrs. Robert Duncan and Co., Port Glasgow, an iron sailing ship of 1,400 tons register, built to the order of of Messrs. Thom and Cameron, Glasgow, for the Australian and Colonial trade. As she left the ways she was named the *Shandon* by Mrs. Cameron, Portland House, Pollokshields. The *Shandon* is fitted up with all modern improvements, and, after completion, proceeds to Glasgow to load a general cargo for Honolulu.

Procida.—On January 24 there was launched from Messrs. Alexander Stephen & Sons' shipbuilding yard, at Linthouse, a very handsome iron-screw steamer of about 3,600 tons, of the highest class in Bureau Veritas, built to the order of Messrs. Robert M. Sloman & Co., of Hamburg, and intended for their well-known Australian line. She has elegant and comfortable accommodation amidships for first-class passengers, and large cargo space, and is provided with all the most modern appliances for the efficient working of the ship and cargo. Her engines, also constructed by Messrs Stephen, have cylinders 44 inches and 80 inches diameter, by 41 in. stroke, with ample boilers adapted for a pressure of 85 lbs., and, as is usual at Linthouse, were fitted on board before launching. This vessel, which is the fourteenth built by the Messrs. Stephen for the same owners, was named *Procida* by Miss Sloan, Philadelphia.

Kingswear.—On January 30 the Cambeltown Shipbuilding Company launched from their yard, French Point, Cambeltown, a steamer of about 500 tons burthen, dimensions being 155 (B.P.), by 25 by 11. This vessel has been built to the order of the Hayton Mining Company, of Kingswear, South Devon, to the highest class of Lloyd's, under special survey. She has every facility for speedy loading and discharging of cargo, and is to be fitted with a pair of compound surface-condensing engines of 70 h.-p. by Messrs. Kincaid and Co., Clyde Foundry, Greenock, The vessel was named the *Kingswear* by Mrs. Broom, Mopoon-terrace, Cambeltown. We understand the Cambeltown Ship-

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding manuscript and newspaper accounts of launches, trial trips, etc. We wish to make this feature of the* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To ensure insertion, all such favours should be in our hands by the 23rd of the month.*—ED.]

LAUNCHES.—ENGLISH.

Buninyong.—On January 23 the new s.s. *Buninyong* was successfully launched from Messrs. Caird, Purdie & Co.'s ship-yard. The new steamer has been built for Messrs. W. Howard Smith & Sons, London and Melbourne, and has a considerable amount of room for passenger accommodation as well as cargo. The *Buninyong* is 280 ft. between perpendiculars; 38 ft. beam; 20 ft. depth of hold, and is classed 100 A 1. She is built of steel, and her gross tonnage is 1900. She is to be fitted up with engines of the most improved type, which will be supplied by Messrs. Jack & Co. Liverpool. At the launch, the vessel was gaily decorated with streamers, and the ceremony of christening was performed by Miss Smith, a youthful daughter of the owner. The launch was in all respects most successful, and amongst the numerous assemblage who witnessed it were Messrs. Caird and Purdie (builders); Mr. Thos. Massicks, Millom; Mr. Howard Smith, Captain Stanford, Mr. Lawrence (Lloyd's surveyor), Mrs. Caird and party, Dr. Murray, Dr. and Mrs. Sinclair, Mr. E. Lawson-Barnes (manager Lancaster Bank), &c., &c.

Hilda—On January 25 a smack was launched from the building-yard of the Whitby & Robin Hood's Shipbuilding & Graving Docks Company. The dimensions are as follows:—Length of keel, 70 ft.; extreme breadth, 19 ft. 9 in.; length between perpendiculars, 76 ft.; length over all, 81 ft. 6 in. The smack was christened *Hilda* by Miss Miller, daughter of Mr. Miller, the managing owner, and makes the third vessel of the class belonging to a local company.

Accornac.—On January 25 Messrs. M. Pearse & Co. launched from their yard at Stockton-on-Tees the steamer, *Accornac*, built to the order of Messrs. W. Tapscott & Co., of Liverpool. The vessel is classed 100 A 1 at Lloyd's, and under the personal superintendence of Mr. Fred. J. Pilcher, Consulting Engineer of Liverpool and London. Her dimensions are:—Length, 300 ft.; breadth, 39 ft., and depth of hold, 26 ft. 6 in., and is capable of carrying 3,300 tons, with water ballast in double bottom, built on the cellular system, and has all the latest improvements. She will be fitted with a pair of engines 230 horse power, by Messrs. Blair & Co., of Stockton-on-Tees.

Sara.—On January 25 Messrs. Edwd. Withy & Co. launched from Middleton Shipyard, West Hartlepool, a large iron screw steamer, built to the order of Messrs. Jos. F. Cohen & Co., of London and Cardiff. The vessel is No. 116 in the Builders' book; her principal dimensions are:—Length, B. P., 257 ft. 6 in.; beam extreme, 34 ft. 6 in.; depth moulded, 20 ft. $4\frac{1}{2}$ in., and her dead-weight carrying capacity will be about 2,350 tons. She has topgallant forecastle, long bridge house, quarter deck, and full poop, and double bottom for water ballast under both holds. The decks, bulwarks, rails and chart house, as also the skylights and companions are of iron; she will be fitted with four steam winches, Messrs. Amos & Smith's steam steering gear, donkey boiler and patent windlass, and will be rigged as a double topsail schooner. She has been built under Lloyd's special survey for the 100 A 1 class and under the personal superintendence of Messrs. Menzies & Blagburn, of Newcastle. Engines of 130 nominal horse power will be fitted by Messrs. T. Clark & Co., Elswick. On leaving the ways the vessel was named *Sara* by Miss Blanche Cohen, niece of Mr. Jos. F. Cohen.

Wellington.—On January 27 there was launched from the shipbuilding yard of Sir W. G. Armstrong, Mitchell & Co., Low Walker, an iron screw steamer of a special description. The vessel was named the *Wellington*, and is built to the order of Sir Robert Dunsmuir and W. N. Diggle, Esq., who have extensive coal mines in British Columbia, and the steamer is for the purpose of carrying the produce to San Francisco and other parts of the Pacific coast. The *Wellington* is a vessel of 2,700 tons burthen. She is built with a view of being able to carry and work a large cargo in the quickest and most economical manner, and her arrangements in this respect are very complete; and, seeing that she will have to make the return voyage in ballast, she is made to carry an exceptionally large quantity, so that the vessel may be well immersed. Her engines, which are on the compound surface-condensing principle, with all the latest improvements for economy of fuel, have been built by the Wallsend Slipway and Engineering Company (Limited). They will indicate 950-horse power, and will give the vessel a speed when loaded of 10 knots.

Edith.—On February 6 there was launched from the iron shipbuilding establishment of Messrs. Harkess & Son, East Slipway, Middlesbrough, an iron screw steamer of the following dimensions:—Length, 251 ft.; breadth, 34 ft. $8\frac{1}{2}$ in.; depth, moulded, 18 ft. 1 in. She is built on the raised quarter-deck system, has long bridge, and topgallant forecastle for the accommodation of crew, &c. The saloon, state rooms, captain's cabins, &c., are fitted under the bridge at fore-end, with accommodation for officers and engineers at after end of bridge. The main quarter and bridge decks, charthouse, and engine-room skylight are all of iron. She has been built under special survey, and will be classed 100 A 1 at Lloyd's. She is fitted with all the latest improvements, including swinging anchor crane on topgallant forecastle for lifting anchors, &c., Harfield's patent windlass, and three powerful steam winches, and large hatchways for the quick loading and discharging of cargo. The vessel will be fitted with two steel boilers, and a pair of compound surface condensing engines, 120 nominal horse-power, with cylinders $28\frac{1}{2}$ in. and 55 in. diameter, manufactured by the Northern Marine Engineering Company, Gateshead-on-Tyne. She will carry about 1,900 tons of cargo, will be rigged as a two-masted topsail schooner, and has been specially designed for the Black Sea and Mediterranean trade, with water ballast under both holds and in after peak. She is built to the order of W. Harkess, Esq., of Middlesbrough, the senior partner of the firm, and will be commanded by Capt. Sellers. On leaving the ways the vessel was christened the *Edith* by Miss Williams, of Clifton, Bristol.

St. Joseph.—On February 7 there was launched from the shipbuilding-yard of Messrs. Kish, Boolds & Co., Sunderland, a screw steamer, built to the order of Messrs. Dussarget, Bonnin & Badille, of Bordeaux. She is of the following description:—220 ft. long, 31 ft. 6 in. broad, and 14 ft. 6 in. deep, having long raised quarter-deck, bridge, and top-gallant forecastle, double bottom built on the continuous cellular system, capable of carrying about 250 tons of water ballast, and is to receive the highest class in Bereau Veritas Registry. She is supplied with Higginson's patent steam quarter-master, Emerson and Walker's patent windlass; also large donkey boiler and powerful steam winches by Messrs. Welford Brothers, of Pallion. Mons. Badille (one of the owners) has personally superintended the building of the vessel, assisted by his engineer, Mons. Brun. The vessel was named the *St. Joseph* by Madame Brault, wife of Mons. Brault, the French Consul at Sunderland. After the launch the vessel was towed to the South Dock, where she is to receive her machinery from Messrs. Carr & Co., of Sunderland.

Ackworth.—On February 8 W. Gray & Co. launched from their yard, at West Hartlepool, an iron screw steamer of the following dimensions:—272 ft. by 35 ft. 6 in. by 20 ft. Classed 100 A 1 at Lloyd's, and built to the order of Messrs. Joseph Merryweather & Co., West Hartlepool. The vessel is intended for the Indian and general trade, to carry about 2,600 tons dead weight. She is of the well-decked type, having raised quarter-deck to engine-room, and bridge before it, also a topgallant forecastle for crew, and double bottom for water-ballast in each hold, patent windlass, and four steam winches. The engines, of 100 horse power, are being supplied by Messrs. T. Richardson & Sons, of Hartlepool. On leaving the ways the christening ceremony was performed by Miss Whatley, the vessel being named *Ackworth.*

Tourmaline.—On February 8 there was launched from Messrs. Richardson, Duck & Co.'s South Stockton iron shipyard an iron screw steamer of the following dimensions:—Length over all, 286 ft.; length between perpendiculars, 277 ft.; breadth, extreme, 36 ft.; depth in hold, 24 ft. 6 in. Gross register tonnage, about 2,100 tons. This steamer has been built to the order of Messrs. C. O. Young & Christies, of Cardiff, and is classed 100 A 1 at Lloyd's, special survey, but her scantlings are in several respects considerably in excess of Lloyd's requirements. She is built on the three-decked rule, the main and upper decks being laid of iron throughout; the greater part of the upper deck is, in addition, covered with yellow pine, leaving a wide waterway at each side. The 'tween decks are fitted with permanent iron shifting boards. The vessel has a double bottom in after hold and under boiler for water ballast, and also a deep tank forward of the engine-room. She has a full poop aft, with accommodation for captain, officers, &c.; an iron house amidships for the engineers, and a topgallant forecastle. She will be supplied with five double-cylinder steam winches, and Harfield's patent windlass. The engines, 160 horse-power, are by Messrs. Thomas Richardson & Sons, Hartlepool, compound direct acting cylinders, 34 in. and 36 in., stroke 36 in., pressure of steam 30 lbs. She will be rigged as a brigantine, and is specially designed for the Atlantic and grain-carrying trade. As the vessel was leaning the ways she was christened the *Tourmaline* by Mrs. Corfield, wife of Captain Corfield, who has superintended the building of the vessel, and will take the command.

H.M.S. *Wanderer.*—On Thursday afternoon (8th ult.) there was launched from the yard of Messrs. Raylton, Dixon & Co., H.M.S. *Wanderer*, the second of the two gunboats building at Cleveland Dockyard for H.M. Navy. The *Wanderer* has been built under the superintendence of Mr. Allen, Admiralty Overseer, assisted by Mr. Adams, and has a displacement of 1,000 tons. She is built on composite principles, having iron frames, steel bulkheads and flats, and the shell consists of two thicknesses of teak—three inches each—copper fastened and screw bolted to the frames. Her stern and keel are of English oak, while her bottom is covered with copper up to the water line. The lining of the poop, cabins, and all the bulwarks are of thin steel plates, instead of wood, to prevent splinters. She is to be fitted with direct acting horizontal engines of 750 indicated horse-power, by Messrs. R. & W. Hawthorn, of Newcastle. Her armament, when complete, will consist of two 6-in. breechloading guns, placed in the forecastle and poop, for chase guns, and two broadside breechloaders of 5-in. bore, one 7-pounder boat gun, and two Gardner guns, which are somewhat similar to the well-known Gatling guns. The arrangements for launching, on this occasion, were made without any ceremony or public notice, but the usual form of service at the launching of Government vessels was performed by the Rev. J. K. Bealey, Vicar of Middlesbro', and the lines which held the dog-shores and christening bottle were severed by Miss Dixon, daughter of the builder, who, in doing so, wished success to H.M.S. *Wanderer*.

Pione.—On February 8, Messrs. Short Bros. launched at Pallion, Sunderland, a screw steamer, built to the order of Mr. J. Sinclair, of Seaham Harbour, of the following dimensions:—Length, 160 ft.; breadth, 25 ft.; and 12 ft. 3 in. depth of hold. She is constructed to Lloyd's 100 A 1 class, under special survey, and has a long raised quarter-deck, extending over engines and boiler, and bridge-house for accommodation of captain and officers, and topgallant forecastle for crew; she has water ballast in after hold and both peaks, three large hatchways, and two steam winches and donkey boiler, Harfield's patent windlass to work by steam winch, and all the decks are of iron, except bridge. On leaving the ways, the vessel was named the *Pione*, the ceremony of chistening being performed by Miss Elliot, of Seaham.

Hartside.—On February 8 Messrs. D. Baxter & Co. launched from their yard at Monkwearmouth a screw steamer, built to the order of Messrs. Charlton, M'Allum & Co., Newcastle. The steamer was named the *Hartside*, by Mrs. William Richardson. The vessel is 185 ft. long, 29 ft. broad, and 13 ft. 10½ in. deep; and is expected to carry 900 tons of cargo on a mean draught of 12 ft. 3 in. of water, and an average speed of nine and a half knots when laden. The engines will be constructed by Messrs. R. & W. Hawthorn, of Newcastle, and will have cylinders 25 by 48 by 30 stroke. The boilers will be of steel, of an extra large size, and a working pressure of 80 lbs.; three large furnaces will have a heating surface of 1,800 sq. ft., and will be adapted for the consumption of small coals. The steamer's decks are of iron, she is fitted to carry water ballast, and among other improved apparatus she will have three steam winches, which will rapidly discharge the cargo.

Crown of England.—On February 9 Messrs. R. Williamson & Son, Workington, launched from their shipbuilding-yard an iron sailing-ship, built to the order of Messrs. Robertson, Cruikshank & Co., of Liverpool. Her dimensions are:—Length, 267 ft.; breadth, 39 ft.; depth, 23 ft. 7 in.; and will register 1,800 tons nett. The vessel has been constructed in excess of Lloyd's requirements, and under special survey, and has been specially fitted out for the Calcutta and San Francisco trades. As she left the ways she was named *Crown of England* by Miss Jenny S. Robin, of Glasgow. The *Crown of England* will sail for Calcutta in the beginning of March, under the command of Captain Jackman.

Erato.—On February 10 William Gray & Co. launched from the yard at West Hartlepool an iron screw steamer of the following dimensions:—262 ft. by 34 ft. 6 in. by 19 ft. 8 in. She has been built to the order of Messrs. Gladstone & Cornforth, West Hartlepool, to carry 2,350 tons deadweight. The vessel is built to the highest class in Lloyd's, and has long raised quarter-deck, and bridge house, also long topgallant forecastle extending to foremast' and double bottom for water ballast in both holds. The engines, which are 150 horse-power, are being supplied by Messrs. Blair & Co. (Limited), Stockton. The christening ceremony was performed by Miss Cornforth, the vessel being named *Erato.*

Yorouba.—On February 10 was launched from the Barrow Shipbuilding Company's Yard a schooner-rigged iron screw steamer, built to the order of Messrs. Verminck et Cie., of Marseilles. Her dimensions are:—Length, between perpendiculars, 270 ft.; breadth, moulded, 35 ft. 9 in.; depth in hold 2; ft. Her gross tonnage is 1,900 tons, and she is built to the highest class in Lloyd's. She is fitted with a poop aft, containing accommodation for 25 first-class passengers. The ship has steam windlass, steam stearing gear, and four steam winches. She has compound direct-acting surface-condensing engines of 175 nominal horse-power, with cylinders of 36 in. and 63 in. diameter, and 48 in. length of stroke, the working pressure being 75 lbs. She has two boilers 12 ft. in diameter and 15 ft. long, and eight furnaces 3 ft. 9 in. diameter.

Tynemouth.—On February 24 Messrs. Robert Thompson & Sons launched at their Southwick Yard, Sunderland, an iron screw steamer of the following dimensions:—Length, 286 ft.; breadth, 37 ft.; depth, 24½ ft.; built to the order of T. H. Dawson, Esq., of Newcastle-on-Tyne, on the three decked rule, under Lloyd's special survey, for the highest class, under the personal superintendence of Captain Tate. She has topgallant forecastle fitted up for crew and firemen; bridge-house amidships for the accommodation of officers and engineers; short full poop aft, fitted up in good style, for captain's room, with spare staterooms; has water ballast in both holds; four hatchways; four steam winches, and donkey boiler, by Messrs. Clarke, Chapman & Co.; Harfield's patent windlass; stearing gear amidships; screw gear aft, &c., &c. She will be fitted with engines of 180 nominal-power, by Messrs. Clarke & Co., Elswick, Newcastle. As the vessel left the ways she was gracefully christened the *Tynemouth* by Miss H. Chaytor, of Claervaux Castle, after which a large number of ladies and gentlemen adjourned to the offices of the builders, amongst whom we noticed Mr. and Mrs. Dawson, Captain and Mrs. Stevenson, Captain and Mrs. Tate, Mr. and Mrs. Wright, Mrs. Diewett, Miss H. Claytor, Miss Scott, Captain Battey, Captain McGregor, Mr. Cuthbertson, &c.

ERRATUM.

Dorothy, built for Mr. H. Champness, should read Mr. H. Champion, and the dimensions are:—Length of keel, 57 ft.; breadth of beam, 18 ft.; tonnage, 44 tons.

LAUNCHES.—SCOTCH.

Shandon.—On January 22 there was launched from the shipbuilding yard of Messrs. Robert Duncan and Co., Port Glasgow, an iron sailing ship of 1,400 tons register, built to the order of of Messrs. Thom and Cameron, Glasgow, for the Australian and Colonial trade. As she left the ways she was named the *Shandon* by Mrs. Cameron, Portland House, Pollokshields. The *Shandon* is fitted up with all modern improvements, and, after completion, proceeds to Glasgow to load a general cargo for Honolulu.

Procida.—On January 24 there was launched from Messrs. Alexander Stephen & Sons' shipbuilding yard, at Linthouse, a very handsome iron-screw steamer of about 3,600 tons, of the highest class in Bureau Veritas, built to the order of Messrs. Robert M. Sloman & Co., of Hamburg, and intended for their well-known Australian line. She has elegant and comfortable accommodation amidships for first-class passengers, and large cargo space, and is provided with all the most modern appliances for the efficient working of the ship and cargo. Her engines, also constructed by Messrs Stephen, have cylinders 44 inches and 80 inches diameter, by 41 in. stroke, with ample boilers adapted for a pressure of 85 lbs., and, as is usual at Linthouse, were fitted on board before launching. This vessel, which is the fourteenth built by the Messrs. Stephen for the same owners, was named *Procida* by Miss Sloan, Philadelphia.

Kingswear.—On January 30 the Cambeltown Shipbuilding Company launched from their yard, French Point, Cambeltown, a steamer of about 500 tons burthen, dimensions being 155 (B.P.), by 25 by 11. This vessel has been built to the order of the Hayton Mining Company, of Kingswear, South Devon, to the highest class of Lloyd's, under special survey. She has every facility for speedy loading and discharging of cargo, and is to be fitted with a pair of compound surface-condensing engines of 70 h.-p. by Messrs. Kincaid and Co., Clyde Foundry, Greenock, The vessel was named the *Kingswear* by Mrs. Broom, Mopoon-terrace, Cambeltown. We understand the Cambeltown Shipbuilding Company are building a second steamer for the Hayton Mining Company, which is to be a duplicate of the *Kingswear*.

Micronesia.—On February 6 Messrs. Russell & Co. launched from Kingston Shipbuilding-yard, Greenock, a ship of 1,580 tons gross. She is 158 ft. long, 38 ft. broad, and 22·9 ft. in depth, and has been builr to the order of Messrs. D. and W. Goff, of Liverpool. As she left the ways she was named *Micronesia*. She is to be employed in the Calcutta trade, and is to be commanded by Captain Greig.

Thistle.—On February 7 an iron screw steamer, built by Messrs. Pearce Brothers, to the order of Bailie Taylor, was launched from Cragie Shipyard, Dundee. She measured 152 ft. long, 23 ft. broad, and 12 ft. 2 in. deep; has been built under special survey; is classed 100 A 1 at Lloyd's; and will be capable of carrying 500 tons dead weight. She has been fitted with all the most approved appliances for the expeditious loading and discharging of cargo, and will be supplied with engines of 70 horse-power. As she left the ways the steamer was christened the *Thistle* by Mrs. Taylor, the wife of the owner. The *Thistle* will be commanded by Captain Inglis, so well known as the master of the *Neilson-Taylor*, and will be engaged principally in providing for the demands of Bailie Taylor's business in Abroath and Montrose, and other towns on the coast.

Peveril.—On February 9 there was launched from the shipbuilding-yard of Messrs. Gourlay Brothers & Co., of Dundee, a steel steamer named the *Peveril*. She has been built to the order of Messrs. Williamson, Milligan & Co., of Liverpool, and is to be commanded by Captain Burgess, late of the *Waverley*. She is to be employed in the East India and Adriatic trades. Her dimensions are as follows:—Length, 350 ft.; breadth, 40 ft.; depth 29 ft. 6 in.; tonnage 3,336 gross, and about 2,260 nett. She will be fitted by the builders with engines of 400 horse-power, and has double bottom on the cellular system, and extra strengthening, and will class 100 A 1 at Lloyd's.

Glengarry.—On February 9 the London & Glasgow Engineering & Iron Shipbuilding Company launched from their yard at Govan an addition to the Glen line of steamers plying between London and China, India, and Japan, managed in London by Messrs. M'Gregor, Gow & Co., and in Glasgow by Messrs. A. C. Gow & Co. The new steamer has a gross tonnage of 3,000 tons, and is built on the double-bottom longitudinal girder system for carrying water ballast, and will be fitted with all the most recent appliances for working the ship, including steam windlass and steering gear. Although the cargo space is remarkably large and carefully prepared for safety, the accommodation for a number of first and second-class passengers has not been neglected. The former will be placed under the poop, and the latter amidships. The *Glengarry* has been built considerably in excess of the 100 A 1 class at Lloyds for a three-deck vessel, and her engines, which are on the compound inverted system, are of 500 nominal horse-power. When the vessel left the ways she was named the *Glengarry* by Mrs. M'Ewen, of Kelvinside.

Elbe.—On February 10 Messrs. Dobie & Co. launched from their Govan shipbuilding-yard an iron screw steamer of about 800 tons gross, classed 100 A 1 at Lloyd's, and built to the order of Messrs. Coverlay & Westray, London, for their Oporto and Hamburg trade. The machinery is being supplied by Mr. William Kemp, engineer, Helen-street, Govan. As the vessel left the ways she was named *Elbe* by Miss Mercer, of Savannah, Georgia (U.S.)

Felix Depeaux.—On February 14 Messrs. H. M'Intyre & Co. launched from their shipbuilding yard at Merksworth, Paisley, the *Felix Depeaux*, an iron screw steamer of 850 tons, built to the order of Felix Depeaux, Esq., Rouen, for the coal trade between Rouen and England. She is classed 100 A 1 at Lloyd's, and fitted out in the most complete manner as a cargo steamer. Her engines are being constructed by Messrs. Fleming & Ferguson, Paisley. The ceremony of naming was performed by Miss A. J. M'Cullock, of Glasgow.

Para.—On February 14 Messrs. Blackwood & Gordon launched from their building-yard, at Port Glasgow, a paddle-steamer for the Amazon Steam Navigation Company (Limited), for their trade on the Amazon river, of the following dimensions, viz.:—Length, 180 ft.; breadth, 28 ft.; depth, 9 ft. 6 in.; gross tonnage, 400 tons. She is to be fitted with a pair of compound diagonal surface-condensing engines of 135-horse power, also made by the builders, and when completed she is expected to attain a high rate of speed. The steamer has accommodation for 60 first-class passengers in houses on deck, and is fitted with shade and awning decks fore and aft. all of teak wood. She is fitted with steam winches, steam windlass, and all the latest improvements suitable for the trade she is intended for. On leaving the ways the steamer was named *Para by Miss Jeanie Blackwood*, daughter of one of the builders, and was immediately thereafter towed into the builders' dock to receive her engines.

LAUNCH.—IRISH.

Teelin Head.—On February 6 Messrs. Workman, Clark, & Co. (Limited) launched, from the Belfast Shipyard, a screw steamer of the following dimensions:—Length, 275 feet; breadth, 35 feet; depth, 20 feet to top of floors; and with a carrying capacity of about 2,550 tons. The vessel is named the *Teelin Head*, and has been built to the order of the Ulster Steamship Company (Limited), of which Messrs. G. Heyn and Sons, Ulster Chambers, Belfast, are the managers, and is intended for the Baltic and Mediterranean trades, principally in connection with this port. The hull is constructed entirely of mild steel, and the scantlings are considerably in excess of Lloyd's rules for 100 A1, their highest class, to which the vessel has been built under special survey. She has a long raised quarter-deck, bridge-house, togallant forecastle, and is schooner-rigged, with two iron masts. The bottom is arranged for water ballast all fore and aft, on the cellular system, with an additional trimming tank in after hold. Accommodation has been provided under the bridge for the captain and officers and a few passengers. The arrangements for loading and discharging cargo are of the most complete description, and include four steam-winches by Taylor, of Birkenhead. The engines, which are to be supplied by James Howden and Co., of Glasgow, are of the compound surface-condensing type, cylinders 31 by 60 and 42-inch stroke, with all the latest improvements, and ample boiler power. After the launch the vessel was towed into the Spencer Basin, from whence she will shortly proceed to Glasgow to receive her engines and boilers, and afterwards return to Belfast for completion. The *Teelin Head* will be an addition to the Head Line belonging to Belfast, and will be commanded by Captain Thomas M'Calmont, senior captain the Ulster Steamship Company's service.

LAUNCHE.—SWEDISH.

Korsor.—On December 28 last this vessel was launched from Kockums Mekaniska Werkstad Malmö. She is a steel paddle steamer, 250 by 34 by 14 ft. 8 ins. Extreme breadth over sponsons 58 ft., and is the first of two similar steamers ordered by the Danish Government for conveying railway waggons across the great belt between Korsor and Nyborg. For this purpose the deck is laid with two lines of rail from end to end, the carriages running on from a specially constructed bridge on shore, and so off again at the other. As it is intended that passengers should dine at this part of the journey, extensive accommodation has been provided for this purpose, in one end for first and second class, and in the other for third class; while there are also retiring rooms and lavatories for ladies and gentlemen, smoking-room, postal service department, &c., &c. All the saloons are supplied by means of a ventilating engine with warm fresh air in winter, and cool air in summer. At a draught of 9 ft. 3 in. the vessel carries 16 waggons, and with the Continental express on board her speed is to be 13 knots. Double compound engines, surface condensing, of the usual inclined paddle type, are supplied by the builders. The dimensions are:—Two cylinders of 34½, and two of 65, stroke 4 ft. 6 in. Steam at 80 lbs. pressure is supplied from four boilers, which are fitted with Fox's patent furnaces. The machinery is designed to give full speed in either direction, as it is not intended to turn the vessel. The *Korsor* is equipped with every appliance for her special work, steam capstans for warping the carriages on board, Harfield's steam windlass, a steam steering engine for each rudder, steam starting gear for the machinery, and steam heating apparatus. For night traffic the electric light is also to be fitted.

TRIAL TRIPS.

H.M.S. *Conqueror.*—The steel-built armour-clad the *Conqueror*, an improved version of the *Rupert*, and declared by Mr. King, an eminent American naval authority, to be "the best specimen of a single-turret vessel yet laid down," has achieved a decided success at the measured mile off the Maplin Sands. This vessel is a mastless sea-going twin-screw ship, combining the powers of the turret and the ram, and having her vital parts so protected against the enemy's projectiles that if the stern and upper works, and even the citadel, should be damaged, stability would still be preserved. This interesting ship left the Nore at nine o'clock on Wednesday morning for the trial of her propelling machinery, prior to its acceptance from the contractors, Messrs. Humphreys. The trial consisted of two parts, the first taking place with the natural draught of the furnaces, while the second was conducted with closed stoke-holes and forced draught. The indicated horse-power, sustained for some hours in each case, was measured, and also the speed of the ship, eight runs being taken over the measured mile, four for each condition. The indicated power contracted for was 4,500-horse, with natural draught. This was obtained without any difficulty, and gave the ship a mean speed of 14¾ knots. The stokeholes having been closed in, and an air-pressure maintained in them capable of sustaining a column of one inch and a half of water, the power rose nearly to 6,000-horse, and the speed of the ship became 15½ knots. As the ship is only 270 feet long between the perpendiculars, and as she had at the time of these trials a displacement exceeding 6,000 tons, the speed attained is somewhat remarkable. The ship was steered by a steam-engine of novel type and great merit, designed and constructed by Mr. P. Brotherhood. The whole of the machinery, both for propelling and steering purposes, worked with great smoothness. The leading features in the design of the *Conqueror* were originally described in a speech by the First Lord of the Admiralty in the House of Commons in discussing a vote on the Navy Estimates for 1878-9. It was predicted that the *Conqueror*, together with the *Collossus* and *Majestic*, would in all probability be "out of date" by the time she was well finished. Happily the time which has elapsed has been turned to account. While the *Conqueror* has been building the improvements that have taken place in armour, guns, and propelling machinery have been so far utilised in respect to this ship as to give her steel-faced armour twelve inches thick, instead of iron for which she was designed. So also the armament in her revolving turret consists of two forty-three ton breech-loading guns, instead of the two thirty-eight tons muzzle-loading guns originally intended. The speed in like manner is considerably in excess of that which was promised. The change from muzzle-loading guns to breech-loading guns not only admits of much greater length of gun, and herefore higher velocities of projectile without increase of strain on the gun, but also avoids the necessity for depressing the gun and bringing the muzzle under the deck for loading.

Bellmore.—On January 20 the new steamer *Bellmore*, 715 tons register, built by H. M'Intyre & Co., Paisley, and engined by Muir and Houston, Glasgow, ran the usual trial trip at the measured mile, making about 9¾ knots, thereafter cruising about for some time without requiring her engines to be stopped the entire day, they working smoothly. She returned to Glasgow in the evening, and is taking in a cargo of coals for Bordeaux. The trial was eminently satisfactory to the owners, Messrs. Bell, Brothers & M'Lellan, Glasgow, and to the builders and engineers.

Loch Tay.—On January 29 the latest addition to the Loch Line of steamers went from Dundee on her trial trip and for the adjustment of the ship's instruments. The *Loch Tay* is a steamer of 256 ft. In length, is about 1,320 tons gross register, and is classed in the Liverpool Underwriters' Registry for 20 years in red. She is built of steel on the cellular system, with double bottom. The saloon accommodation is fitted up for 12 first-class passengers, and is placed amidships, as are also the officers' quarters. The vessel is intended for the Mediterranean, West Indies, and Baltic trades, and has been fitted up with engines of 180 horse-power nominal. The boilers are also of steel, and the working pressure is 100 lbs. per square inch. During the run at the trial an average speed of 12 knots an hour was attained, notwithstanding a strong head wind and a somewhat lumpy sea—a legacy of the stormy weather of the past few days. All the machinery wrought smoothly, and much satisfaction was expressed with Amos & Smith's noiseless stearing gear.

Monkseaton.—On January 30 the trial trip took place of the new iron screw steamer *Monkseaton*, built for Messrs. Elliott, Lowrey & Dunford, Newcastle, by Messrs. C. S. Swan & Hunter, Wallsend. This vessel will carry a cargo, including fuel, of about 4,200 tons dead weight, and has full poop, long bridge-house, top-gallant forecastle, double bottom for water ballast, &c., large fresh-water condensers, and 'tween deck lights for the cattle trade, or coolies, and is of the following dimensions and tonnage:—Length, between perpendiculars, 325 ft.; breadth, 39 ft. 9 in.; depth of hold, 26 ft. 6 in.; tonnage, 2,899 gross, 1,892 nett register. The engines are 38 in. and 78 in. diameter, by 48 in. stroke, and are constructed of extra strength, and with unusually large steel boilers, by Messrs. R. & W. Hawthorn, Newcastle. The steam steering gear is by Messrs. Donkin & Nichol, and the steam winches and donkey boiler by Messrs. R. Roger & Co., Stockton. The trial trip was very satisfactory, and, after testing speed at the measured mile, when an average speed of about 13 knots was attained, the *Monkseaton* proceeded on her first voyage to New York.

The Itaporica.—The official trial trip of this paddle steamer took place in the River Thames lately, and proved very successful, the four runs on the measured mile giving a mean speed of 13 odd miles per hour on a consumption of only 2 lbs. of coal per indicated horse-power. This vessel is 100 ft. long by 18 ft. 6 in. beam, has a draught of 3 ft. 6 in., and is worked by oscillating paddle engines of 30 horse-power. She is intended for passenger traffic in the Brazils, and was built to the order of Messrs. Knowles & Foster, the London agents of the owners, and will be steamed out under the command of Captain Lewis. She was built by Messrs. John Stewart & Sons, of Blackwall, and designed by Mr. G. Hollingum.

Frederic Morel.—This screw steamer, whose dimensions are 250 ft. by 33 ft. by 23 ft. built to the highest class in Veritas, on the spar deck type, recently launched by Messrs. John Readhead & Co., South Shields, for French owners, has had a successful loaded trial trip with a consumption of fuel much lower than the ordinary run of cargo steamers. The vessel was laden with 1,800 tons deadweight on a mean draught of 18 feet; the speed attained, out of a mean of two hours' steaming, was 10½ knots per hour. The engines, which have also been constructed by John Readhead & Co., are of the inverted vertical type, and are fitted with steem reversing gear. The sizes of the cylinders are 32 inches and 61½ inches diameter, with 36-inch stroke, and 70 lbs. working pressure, running 59 revolutions per minute, indicated 805 horse-power, and the consumption of Newcastle coal being only 1,148 lbs. per hour, equal to 1·426 lb. per i.h.p. The engines are supplied with steam by two boilers of the builders usual construction, each boiler having three furnaces, and with a total heating surface of 3,000 square feet.

Elsa.—On January 1 the new iron screw-steamer *Elsa* went down the Clyde on her official trial trip, and attained a speed of 11 knots under easy steam. This steamer has about 1,300 tons carrying capacity, being 215 feet by 31 feet by 15 feet, with raised quarter-deck, bridge-house, and topgallant forecastle, iron decks, water ballast, patent windlass, &c. She has been built by the Campbeltown Shipbuilding Company to the order of Messrs. Robert Monteith & Co., Glasgow, for the Steamship *Elsa* Company, Glasgow, and fitted by Messrs. Kincaid & Co., Greenock, with engines of about 110-horse power nominal, all to Lloyd's highest class. The construction of hull and engines has been superintended throughout by Messrs. MacNicoll and Smith, Glasgow. She will run in the fruit, ore, and coal trades under the command of Captain William M'Kinlay, of Campbeltown.

The *Sylvan*.—On February 6 the trial trip of the *Sylvan* (s.) took place on the Clyde. About 50 ladies and gentlemen embarked on board the *Sylvan*, which then proceeded to the head of the Gareloch, where the most of the day was occupied in the adjustment of her compasses. The *Sylvan*, in returning home, made a very satisfactory trial at the measured mile, and the company were landed at Prince's Pier close upon six o'clock. The *Sylvan* is owned by Messrs. Wilson, Hart, and Co., Maryborough Saw and Plane Mills, Queensland, and is intended to ply along the Australian coast, carrying general cargoes. The contractors for the ship are Messrs. Duncan, Stewart, and Co., for whom the hull was built by Messrs. Murdoch and Murray, of Port Glasgow. She is entirely of iron, and the deck is also of the same material. The vessel will be commanded by Captain Malcolm Ross Brown, who has come all the way from Australia to take her out. She will leave this country in the course of ten days, and proceed direct through the Suez Canal to Queensland. She is 120 feet long, is propelled by engines of 120 horse-power, and is admirably equipped. She can proceed by sail as well as steam.

Mexican.—On February 6th the trial trip of the passenger steamship *Mexican*, by Mr. James Laing, Sunderland, for the Union Company, took place. The *Mexican* is 390 ft. long, 47 ft. broad, 33 ft. deep, and 4,669 tons burthen, being, in fact, the largest vessel yet launched in Sunderland; and her engines, 600 horse-power nominal, built by Messrs. George Clarke & Sons, Southwick, are the largest which have yet been turned out of any shop at Sunderland. The chief saloon is 37 ft. in length and 46 ft. in breadth, about the full breadth of the ship. The *Mexican* will be commanded by Captain Coxwell, and will have a crew of 120, all told, including four officers, surgeons, stewards, and six engineers. The engines are of a powerful description, and have been constructed by Mr. G. Clark, at Southwick Engine Works. They are on the compound surface-condensing principle, of 600 nominal horse power. The cylinders are 50 in. and 94 in., with a stroke of 54 in.; the crank shafts and propellers are of steel, manufactured by Vickers, of Sheffield. The boilers are three in number, but, being double-ended, are equal to six of the ordinary kind. They are constructed of steel, each being 12 ft. 8 in. wide, 16 ft. 6 in. high, and 17 ft. 6 in. long, and have Foxe's patent corrugated furnaces (numbering 18), affording altogether a heating surface of 10,000 square ft., and a working pressure of 90 lbs. The engines are fitted with every appliance calculated to economise labour and fuel, including steam starting gear, Weir's patent feed-heater, Thomson's air extractor, and Buckley's patent pistons. The pumping power provided is very considerable, as in addition to the ordinary engine pumps, a 12-in. Guynnes' "Invincible" and a large donkey engine are fitted. The provision made for the safety of the passengers and crew, supposing they are compelled to leave the ship, is 11 boats, which hang upon patent screw davits, which upon occasion will lift the boat bodily out into the water without much chance of accident. The vessel is double-bottomed, and divisible into water-tight compartments. Owing ro the state of the weather no real trial of her speed was attempted, but even under the circumstances the engines worked up to 64 revolutions per minute, indicating about 3,000 horse power, and the speed attained was 14½ knots per hour. This result must be extremely satisfactory to both builders and owners, for while neither the maximum horse power nor the speed were tried for, the contracted speed—14 knots per hour—was more than attained, and with a fair trial 15 or 16 knots are likely to be made.

Polcevera.—The large iron screw-steamer *Polcevera*, built and engined by Messrs. Blackwood and Gordon, Port Glasgow, went on her trial trip lately. The weather was most unfavourable, heavy snow showers and a strong east wind prevailing during the day. On the average run at Skelmorlie the steamer attained a speed of 11⅛ knots, which was considered a fair rate under the unpropitious circumstances. The *Polcevera* has left Port Glasgow for Cardiff to load coal for Genoa, from which port she is engaged to carry 500 emigrants to the River Plate, South America.

Cintra.—On February 10 this new vessel, built by Messrs. Napier, Shanks, and Bell, and engined by Messrs. John and James Thompson, had a very successful trial trip. The steamer is sister ship to the *Rockton*, built and engined by the same firms in the autnmn of last year for the Australasian Steam Navigation Company of Sydney, New South Wales. She is 270 feet long, 37 feet broad, and 24 feet deep, with a gross tonnage of 2,000. She can accommodate 72 first, and 80 second and third-class passengers. The cargo space has been well attended to, and ample provision has been made for goods of a miscellaneous order. All the latest improvements to ensure comfort and safety at sea have been adopted, with both Board of Trade and Lloyd's requirements. Messrs. Bow and M'Lachlan's steam steering gear has been fitted up, and the *Cintra* will, no doubt, prove a valuable addition to the Australasian Steam Navigation Company's fleet when she gets out to New South Wales to join her sister the *Rockton*. The vessel had several runs on the measured mile off Skelmorlie, and the speed attained was 12½ knots, with 56 revolutions per minute, during which the engines developed about 1,900 horse-power.

Phra-Chom-Klao (s.)—On February 11 the preliminary trial trip of the screw cargo steamer *Phra-Chom-Klao* (lately built by Messrs. Caird & Co. to the order of Mr. Sinclair, Bangkok) was made, and proved highly satisfactory. The steamer is built for the cargo trade in Siam waters, and her dimensions are as follow:—Length, 265 feet; breadth, 35 feet; and depth of hold, 23 feet. She is a vessel of about 1,500 tons register, built as a two-decker, forecastle amidships, and poop. While the trial trip was being run the weather was exceedingly bad, snow having fallen very heavily. At the measured mile two runs were made. The time for the first mile was 4 min. 53 sec., and the speed attained was 12·286. For the second mile the time was 4 min. 24 sec., the speed being 13·6. Tbe trial was thus satisfactory, the guarantee speed being 11½ knots an hour. Regarding her engines, it may be said that during the running of the mile they were going at the rate of 70 revolutions per minute. They indicate 220 horse power. She is fitted with two boilers and six furnaces, and the pressure shown during the run was 80 lbs. per square inch. As stated above, the steamer is built for carrying cargo, and is fitted with all the new appliances for facilitating quick discharge, &c. She is built on the double-bottom cellular system, with capacious water-tanks, and had on board at the trial about 1,000 tons dead weight. When put down to her load aft the *Phra-Chom-Klao* will carry 2,000 tons cargo, and give a speed of 11 knots.

Ybarra, No. 4.—On Feb. 15 there proceeded to sea from Middlesbrough, on her trial trip, the *Ybarra*, No. 4 (s.), built by Messrs. Raylton Dixon & Co., to the order of Messrs. Ybarra, Hermanos & Co., of Bilbao. She is built on awning-deck rule, and of the following dimensions:—Length over all, 280 feet; breadth, 39 feet; depth, 18 feet 9 inches; and will carry about 2,900 tons dead weight. She has been built under the superintendence of Captain Otero, for her owners, and is the largest steamer yet turned out for the iron ore trade. Her engines, of 200-horse power, fitted by Messrs. Blair & Co., Limited, of Stockton, worked very satisfactorily, and gave a speed of about 11 knots.

Gambetta.—On January 15th the steamer *Gambetta*, built by Messrs. Duckitt & Berry, of Liverpool, to the order of J. De Voogd, Esq., of Liverpool, went on her trial trip on the Mersey. She is a vessel 62 ft. 6 in. by 10 ft. by 6 ft., and has a pair of high pressure engines 12 by 12, built by Messrs. Plenty & Son, of Newbury. The vessel has been built specially for trading and towing on the African Rivers, under the superintendence of Mr. F. J. Pilcher, Consulting Engineer of Liverpool and London. The speed obtained was 9½ knots, and during the trial she gave great satisfaction. A French crew has been engaged to steam her out to Africa.

Esk.—The new steamer *Esk* built by the Barrow Shipbuilding Co., for the West India Royal Mail Steam Navigation Co., which on January 20th, made a speed of 12¼ knots on her preliminary trial at Seascale, has since been taken round to Southampton, and from there proceeded on her official trial about the 17th of February. She averaged rather more than her stipulated speed of 13 knots. The dimensions of the vessel are:—Length, 300 ft.; breadth, 35 ft. 10 in.; and depth to upper deck, 24 ft. 6 in.

BATTLE SHIPS.

At the Royal United Service Institution, under the presidency of Admiral Sir Astley Cooper Key, Mr. N. Barnaby, C.B., the Admiralty Director of Naval Construction, read a paper, under the title of "Battle Ships—a forecast." The walls of the lecture-room were hung with various diagrams, the most remarkable being a full-length drawing of the ponderous 100-ton breech-loading gun (Italia). The size of the cartidges and projectiles of other large ordnance was shown in black on the screen. Sections were also given of the 80-ton muzzle-loading, and 100-ton (Italia) breech-loading, and the projected 63-ton breech-loading guns. The lecturer began by saying that he considered the power of waging war on the seas depended upon the following elements, stated in their relative order of importance:—The quality and extent of the mercantile marine in ships and men, provided that the national tie in both were real and firm; the quality and strength of the trained *personnel* in the State Navy; the ability to produce or procure rapidly and continuously material of war for the use of the State; and the number and efficiency of the regular ships of war possessed by the State on the outbreak of war. Battle ships formed a part of the last-named element. There had been much controversy concerning the distribution of their armour, the size, number, and mode of mounting the guns, their speed and coal endurance, and other matters. But these questions all resolved themselves into one size of ship. Armour, guns, speed, and fuel all demanded as much as could be conceded to them; and the limit to each was finally imposed by the size or displacement of the ship. The controversy had taken form and shape in Italy in more imposing proportions than it had in England or France, and it had fastened itself on the question of absolute size. He then quoted the views of Signor Brin, the ex-Minister of Marine of Italy, in favour of large ships of great power, neither adopting nor challenging the arguments set forth, but contenting himself by saying that with increase in speed and size the ship not only increased in mass, signifying greater energy in striking at given speeds, and greater resistance to injury when struck, but it became more easy to secure speed and endurance. England possessed exceptional advantages in forging such weapons, and, within the limits imposed by sizes of docks and shoaling of water, it was conceivable that she might furnish herself with ships far more powerful than any which had been yet seen. He passed on then to explain some interesting diagrams which set forth the relative State naval power of England, France, Italy, and Germany, as distinct from the possession of merchant ships capable of being turned to war uses. The naval power of England in iron-clad ships on the seas, as seen in the diagrams, nearly equalled the combined powers of France, Italy, and Germanv; this, however, without taking into account the projected war ships of France. The diagram relating to the British Navy showed only two wooden ships, while the diagram of the French showed a large number of the ships to be of wood. He also showed by diagrams that the British merchant ships steaming 14 knots ocean speed, and capable of being made additions to the naval power, greatly preponderated in number over similar ships possessed by the combined Powers. He then proceeded to say that constantly-improving modes and means of attack upon ships by ships, and from the shore, threatened to change the character of the battle ship, and it was this uncertainty which emphasized the financial limitation. The recent operations at Alexandria showed that for certain portions of the work the navy was called upon to perform the ships designed 20 years ago were still efficient; but the neglect of torpedo defence on the part of the Egyptians counted much in favour of the attack. What the future battle ship of England should be might be gathered from what it would be required to do—namely, "It must be capable of striking very destructive blows where the enemy is fortified, either in his ships on the open waters, or in his forts upon the sea-coast. The machinery for striking these blows must be capable of being kept in position in the face of an enemy in the open sea or off a port. The use of torpedo-boats of high speed and in great number tends to the gradual extinction of the power of attacking or blockading the sea fort of an enemy by means of large ships, because of their great cost and the risk of fatal blows from the torpedo. The advantage of being able to inflict damage upon the shipping which may be under the protection of land fortifications, or to close the port, will also be so great that the mode of attack must modify itself to suit the change in conditions. There can be no doubt that gun vessels with numerous long-range shell guns, and costing not more than one-fourth of the modern battle ship, will displace the battle ship for this service, notwithstanding the disadvantages of the smaller ships in unsteadiness of platform and inferior seaworthiness." He urged that the battle ship of large size was not only likely to become obsolete for the attack and blockade of forts, but also for the important service of harassing the commerce of an enemy. This resulted from the great speed and coal endurance of the large ocean steamers. Armed ships of the same character as those to be captured would probably be the favourite weapons for inflicting damage upon commerce. These ships were now nearly twice as long as the ship of war of the same weight, and could, therefore, much more easily secure and maintain a high rate of speed at sea. He considered it would be the most impolitic to build regular ships of war on similar principles for the purpose of pursuing and engaging them. The 15 knots ocean speed of to-day might be exceeded by commercial rivalries in the course of a very few years. It was desirable that this should be so; and, instead of attempting to produce fleets of regular ships of war as a consequence of the existence of these fast possible war cruisers, we should endeavour to modify them and incorporate them in our national defences. Guarding himself against the advocacy of any particular policy, he sketched out, as one of the possible ships of the future, a small and fast "protected" but unarmoured vessel, to be in association with battle ships. The smaller ships would be of from 2,000 to 3,500 tons, with two 25 or 30 ton guns, one firing ahead, the other astern. These ships would be associated with those recently commenced, which would have, probably, 63-ton guns (breech-loading) or heavier. An interesting discussion followed, in which Admiral Boys, Admiral Ryder, Captain P. H. Colomb, R.N. (Gold Medallist of the Institution), Captain Orde Brown, and others took part.

New Shipbuilding Yards.—The shipbuilding trade still shows no signs of decreased activity. In addition to the three new yards at Elswick, Wallsend, and Howden, on the Tyne, which were recently announced, two more are to be opened on the same river, the one at Bill Quay by Messrs. Vaughan & Dymond, and the other at Hebburn by Messrs. McIntyre Bros., one at least of the partners in the last named firm being well known in connexion with the neighbouring yard of Messrs. Palmer & Co., in Jarrow.

It is stated that Messrs. P. Henderson & Co., of Glasgow, have arranged with Messrs. William Denny & Brothers, shipbuilders, Dumbarton, for the construction of three steamers of 5,000 tons gross register for Shaw, Savill, and Albion Company's line from London and New Zealand. These steamers will have large accommodation for cabin and steerage passengers, and will be fitted up with refrigerators for conveyance of fresh meat from New Zealand, the first importation of which was successfully made in that company's ship *Dunedin*.

On the 19th February judgment was given in the Southwark County Court in the case of Grace *v.* Cawthorn. The plaintiff was a fireman on board the *Ransome*, a merchant steamer, and sought compensation for an accident on board that vessel. The main questions were whether he was a "seaman," and whether he came within the provisions of the Employers' Liability Act. His Honour decided that the man was not a seaman, and that judgment must be entered in his favour, with costs. He had recovered £50 damages, subject to leave to enter a nonsuit.

ON THE PROPER MANAGEMENT OF MARINE BOILERS.

THE collapsing of the furnaces of the boiler of a Leith steamer, followed as it has been by a Board of Trade Enquiry, resulting in the suspension of the certificate of the chief engineer, and the imposition of a fine upon the shipowner, has brought prominently forward the danger of using the modern marine boiler, working at high steam pressures, without careful management at sea, and careful inspection and cleaning when in port.

Similar accidents have been only too frequent during the past few years, and although in most of the cases the formality of a Board of Trade Enquiry has been dispensed with, and the accidents themselves have in consequence not been made very public, most, if not all of them, have been occasioned by "*dirt*," using the term in the Palmerstonian meaning as "matter in the wrong place." In some of the cases the *dirt* has been common salt, through allowing the boiler water to become saturated with saline matter. In others, it has been ordinary scale, which has been allowed to accumulate of too great a thickness through neglecting the use of the scaling hammer, while in other cases—notably that of the ss. *Roumania*, a report on which, made by Lloyd's chief engineer surveyor, appeared in our No. for October, 1881. The dirt appears to have been a dark gluey substance, apparently composed of oil carried over from the cylinders, and mixed with mud or other dirt from the feed water.

In most of the collapses of furnaces which have occurred, the appearance of the furnace plates after the accident shows clearly its cause; in some few cases, however, the fact of the furnace crowns being found to be clean on the vessel's arrival in port, gives an air of mystery to the occurrence, but a little reflection will show that in such cases the first mentioned kind of *dirt* is in all probability the prime cause of the accident.

We suppose that every sea-going engineer is aware of the fact that *steam* is composed of *pure* water, and that so long as *pure* water is supplied for the feed water, and an equal weight of *steam* only leaves the boiler, so long will the composition of the boiler water remain unaltered. If it is originally fresh it will remain fresh; if originally salt of any particular density, it will remain salt and of that particular density. If, however, instead of *pure* water being used for the feed, an impure or salt water is used, and still nothing but steam is taken from the boiler, the whole of the impurities, whether they be salt, mud, or anything else, will remain in the boiler, and consequently the condition of the boiler water will continually tend to become more and more impure, and in time must become unfit for use.

A little reflection must show that at sea the feed water can never be absolutely *pure*, while in many cases it may be very far from such a condition. We have not yet arrived at such a state of perfection that condensers, glands, steam-pipe joints, &c., are made absolutely tight, and the whole of the loss of steam from joints, &c., must be made up to the boiler at sea from the sea itself, so that of necessity some small amount of sea water must be continuously supplied to the boilers; and although the supply thus added may be very small in proportion to the whole amount of the feed water used, yet the aggregate amount in a long voyage may be very great; while, if the condenser happens to get leaky without those in charge of the engines being aware of it, a very great quantity of sea water may find its way into the boiler in a very few days. Even if the condenser is perfect, out of the total amount of oil used for the lubrication of the cylinders and slides, a large portion eventually is carried into the boiler along with the feed water, and once there it usually remains there until taken out together with other *dirt* when the boiler is being cleaned.

As we have above remarked, this oil often has caused serious accidents, but for the present we wish to confine ourselves to the question of the danger of using salt or sea water.

It does not appear to be universally known amongst those having the care of marine boilers, that so far as the effects of the solid matters contained in the sea water are concerned, they may be considered to consist mainly of two distinct kinds of substances. One portion being mainly common salt, together with a little chloride of magnesia, is very soluble in water at any temperature, and sea water must be evaporated to a very great extent before this portion becomes separated or deposited. The other portion consists mainly of sulphate and carbonate of lime, which are very sparingly soluble in cold water, and almost insoluble in water at the temperature at which steam is formed at the pressures now usually carried. If, therefore, any sea water is put into a boiler and raised in temperature to the boiling point, the soluble portions of the solid matter still remain dissolved, but the whole of the lime salts are deposited in a solid form. It is these salts, thus deposited, which constitute the greater portion of ordinary boiler scale.

If from any cause it is inevitable that sea water must be used, either wholly or partly as feed water, two courses are open to the engineer: He may either allow matters to take their course, and the whole of the salt, &c., thus put into the boiler to remain there, in which case the lime salts will become deposited in the boiler, but the soluble salts will remain in solution, and the water will become denser and denser up to the point at which it becomes *saturated* with these salts; any additional salt then added must become deposited, and the boiler will be *salted*. This, however, will not happen until the water is *saturated*. On the other hand, he may, by *brining* or *blowing off*, prevent the density of the water from exceeding any desired amount, by discharging from the boiler, when this density is reached, just so much saline matter as enters with the feed. Suppose, for instance, it is deemed to be imprudent to allow the water in the boiler to become of greater density than that due to *twice* the saltness of the sea, then in order to do this for every gallon of sea water introduced into the feed, after this density has been reached, *one half* of a gallon of boiler water must be blown out of the boiler; if the density is to be kept at three times the saltness of the sea, water must be blown out to the extent of one-third of the amount of sea water used with the feed. With this method of treatment the boiler water does not become abnormally salt, but, as blowing out has been resorted to, the waste of water thus occasioned has also to be made up with sea water, and thus more sea water has to be used altogether than would have been the case if the first course had been practised. As we have seen, the whole of the lime salts of the sea water must in either case be left in the boiler, so that by adopting the method of procedure last mentioned, a greater quantity of scale will be formed in the boiler. The apparent anomaly that in cases where it is necessary to use some salt water along with the feed, the salter the water is maintained in the boiler the cleaner it will be found, is thus seen to be due to the fact that by allowing the water to become very salt in the boiler, a less total amount of sea water has to be used; but it should always be remembered that it is possible to carry this practice to a dangerous extent, so that a degree of saltness may be obtained which in itself will be far more dangerous than an accumulation of thin hard scale.

If we suppose that in any case the water has been allowed to become so salt that an actual deposition of salt has taken place, it will be obvious at once that as this salt is so very easily soluble that a very limited amount of blowing down and replacing with sea water will sufficiently freshen the boiler water to re-dissolve the deposited salt; and there can be no doubt that some of the cases of mysterious collapses of furnaces are mysterious because the fact has been carefully suppressed that the donkey has been kept on after the accident, and has thus removed all traces of the actual cause of collapse.

It is within our knowledge that many, very many, steamers are habitually run, and some of them on long voyages, without the engineers troubling at all as to the density of the water in the boilers, they preferring to leave to chance such important matters, rather than be troubled with trying the density by salinometer, trusting to the tightness of the condenser, and to their experience in similar voyages, not having come to any trouble through such neglect. They, however, do not know how narrowly they may have previously escaped disaster, nor how near to danger point they may be at any moment.

There appears to be some diversity of opinion amongst sea-going engineers as to the amount of boiler scale which is permissible upon the heating surfaces. This question is one which can be looked upon from three different points of view. 1. Present safety. 2. Efficiency of the surfaces for the transmission of heat; and 3. Preservation of the internal surfaces from corrosion or pitting.

With regard to the first point, experience shows plainly that the accumulation of scale upon some parts of the boiler is harmless, while upon other parts it becomes very dangerous. On the outer shell and stays, for instance, its presence is practically immaterial; while on the furnace crowns, back tube plate, and parts of the combustion chamber plating, where the heat acts most intensely, a very thin deposit is sufficient to produce collapse, or cracked or bulged plates. Further, on all the riveted joints exposed to the fire, whether they be of patches or the junctions of the various plates, unless the whole of both plates near the joints be kept very clean, the resistance to the transmission of heat, opposed by the two thicknesses of plate, causes that part nearest the fire to become over-heated, and cracks at the rivet holes, and leaky seams are the consequence. Although at first starting leaky seams and bulged plates may cause more anxiety from the trouble and labour involved in endeavouring to keep them tight, yet if they are neglected, they may become sources of actual danger to the boiler.

With regard to the second and third points we need hardly remark that the cleaner the heating surfaces are maintained the more efficient they will be in transmitting the heat, and consequently, the more economical in fuel will the boilers be; on the other hand, in many cases it has been found that a thin coating of scale is the best possible protection of the plates against corrosion. If a coating of scale, however thin, can be got to properly adhere to the plates, complete protection is obtained, but this is not bettered in any way by putting on a thicker coating, nor is the adherence of a thick scale any greater than that of a thin one. A scale, therefore, no thicker than $\frac{1}{32}$ of an inch is quite as good for protecting properties, and not nearly so bad for heat resisting properties than one $\frac{1}{8}$ of an inch thickness, while no scale at all is required upon those portions of the boiler which show no tendency to corrode.

These questions, however, viz., efficiency and protection, are mainly of interest to the shipowner, as they directly affect his pocket; while so long as the accumulations of scale do not become so great as to affect the safety of boiler, or to give trouble through causing leaky tubes or joints, they do not force their attention upon the sea-going engineer, who can hardly be expected to think more of the shipowner's interests than of his own personal comfort, especially in those cases in which the engineers are like birds of passage, seldom making more than one voyage in any particular vessel.

The interests of the shipowner are clearly to insist upon the boilers of their vessels being properly managed, and in our opinion it is their duty to supply proper salinometers to all their steamers, and to *insist* upon their being periodically used. They should require the chief engineer at least once a day to personally test the density of the water in the boilers and to *himself* insert particulars of the result in the engine room log. To engineers we would give the following advice.

1. Be careful to keep the surface condenser as tight as possible, and when under weigh occasionally test its tightness by testing the feed water for saltness.

2. Never be without a salinometer in the engine-room, and do not fail to use it at least once a day, even although you feel confident that the condenser is perfectly tight.

3. Upon no account allow the density of water in the boilers to become greater than that due to *four* times the saltness of the sea. Many engineers think that *three* times is quite as salt as prudence admits.

And 4. Keep the boilers clean internally, never allowing the accumulation of scale upon the heating surfaces to become thicker than $\frac{1}{32}$ of an inch, especially upon those parts exposed to the fiercest action of the heat. As a general rule, the cleaner a boiler is kept, the less will it require the attentions of the boiler makers.

Her Majesty's Ship "Neptune."—A most extraordinary discovery has been made in connection with the *Neptune*, sea-going, full-rigged, first-class double turret ship, at Portsmouth, and Mr. F. K. Barnes, Surveyor of Dockyards, was sent down from the Admiralty to make an examination of the ship and report upon her condition. The *Neptune* was formerly named the *Independencia*, was purchased from the Brazilian Government in the spring of 1878, and is of 9,310 tons displacement, and 8,000-horse power. On arriving at Portsmouth, her armament of Whitworth guns was changed to guns of the service pattern, her rigging and masts were altered, and numerous other departures from her original trim and equipment were made. She has never yet been in commission, but, as it was intended to despatch her to strengthen the Channel Squadron, she was recently docked for the usual scrub down. This docking has been the means of disclosing a serious state of affairs, as regards the condition of her hull. Below the water-line the vessel is sheathed with wood, upon which copper is fastened for the purpose of preventing fouling; but the sheathing appears to have been so imperfectly fitted that the sea water has penetrated between it and the iron plating, so that galvanic action has set in between the copper plating and the iron skin. The heads of the iron bolts are eaten away, and, judging from the exudation of rusty water from all parts of the bottom through the copper, it would seem that the iron plating of the ship must be seriously affected. Nor is this all, for, having settled down on the blocks, the false keel, the wood of which is in good condition, has been slightly "hogged" by the weight of the superincumbent mass, and it is probable that the keel-plates have in parts been seriously weakened. The *Neptune* is oversparred, and, as the unanimous testimony of officers who took part in the bombardment of Alexandria is that the ironclads engaged would have been better without masts, it is probable that the masts of the *Neptune* will have to be removed, and that she will be converted into a sea-going turret ship for the defence of the Channel. The alteration would also improve her angle of vanishing stability, which is now 56 deg.

The estimate for repairing the Royal yacht *Victoria* and *Albert* is understood not to have been finally approved, as it is intended to include it in the accounts for the forthcoming financial year. Mr. N. Barnaby, Director of Naval Construction and the Surveyor of Dockyards, has just completed inquiries at Portsmouth, with reference to the constructive work in hand and the proposed work for the forthcoming financial year. During the next month four vessels are, according to present arrangements, to be put in commission.

On February 27th, Messrs. R. Napier & Son, Lancefield, launched the war ship *Phaeton*. She is over 3,000 tons burden, 5,000 horse power, and is built entirely of steel. She is armed with ten 6 in. guns, two gatlings, six Nordenfelt guns, and ten torpedoes. The coal bunkers protect the machinery and magazines. The vessel is intended to attain a high speed.

The report to the directors of the Mersey Railway Company by the engineers, Messrs. Brunlees and C. D. Fox, which will be presented at the meeting of the company next Tuesday, states that:—"During the half-year the contractor, Mr. Waddell, has used every exertion to push forward the works, concentrating his efforts chiefly upon the headings, and upon the tunnels under the river. The headings have now advanced to a total length of 717 yards, of which about 182 yards are under the river Mersey, and are being lined as they proceed. The excavations for the main tunnels have proceeded to a total length of 1,054 lineal yards, and have been lined with brickwork for a length of 939 yards. The sandstone rock continues of the same satisfactory character. In order to expedite the work, arrangements have now been entered into for excavating the heading on the Birkenhead side by means of a machine designed by Colonel Beaumont, driven by compressed air. A preliminary trial has been made in the sandstone rock on the surface, which gave good results, and from which Colonel Beaumont estimates that a speed of 30 lineal yards per week could be attained.

The boring of a tunnel 4,000 ft. in length under the river Hudson at Weehawken, N.J., has been completed. Most of the tunnelling has been boring through rock from several faces, entered by five shafts, seventy air rock-drills having been employed on these faces, The tunnel is 27 ft. wide and 21 ft. high.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

January 27th, 1883.

Auld, John	2 C	Glasgow.
Constantine, E.G.	1 C	Lvrpool.
Dormand, Chas.	1 C	W Hrtpl.
Griffiths, Geo. A.	1 C	Livrpool.
Inglis, Robt. ...	2 C	Glasgow.
Kay, David J. ...	2 C	Lvrpool.
McAinsh, John	2 C	Glasgow.
Mitchell, Archd.	2 C	do.
Moss, Thomas ...	2 C	London.
Osman, Henry J.	2 C	Bristol.
Reid, Robt. S.	1 C	Glasgow.
Scott, James......	2 C	do.
Smith, Josph. T.	1 C	Bristol.
Sproat, James ...	2 C	Lvrpool.
Thomas, Wm. J.	2 C	Bristol.
Tilbrook, W. J.	2 C	Livrpool.
Wilson, Hnry. D.	1 C	Bristol.

February 3rd, 1883.

Anderson, David	2 C	London.
Auld, James......	2 C	Lvrpool.
Boardman, R. F.	2 C	N Shlds.
Coxon, John......	2 C	do.
Crawford, Joseph	2 C.	Lvrpool.
Hartley, John ...	2 C	do.
Johnstone, A. B.	2 C	do.
Kennedy, David	2 C	do.
Ladmore, W. H.	2 C	do.
Miller Chas.	2 C	N Shlds.
Nicholson, J. P.	2 C	do.
Porteus, James...	2 C	do.
Scott, Robt. A.	2 C	London.
Shepherd, Jos. A.	2 C	Bristol.
Shott, Charles ...	2 C	N Shlds.
Sinclair, John ...	2 C	London.
Taylor, James ...	2 C	Lvrpool.
Thomas, Alf. E.	1 C	do.
Walker, John G.	2 C	N Shlds.
Wildish, Fred. W.	1 C	Lvrpool.
Williamson, R.R.	1 C	do.
Wright, Thomas	2 C	N Shlds.

February 10th, 1883.

Alexander, Wm.	2 C	Glasgow.
Barker, John ...	2 C	N Shlds.
Bedford, Edw. A.	2 C	London.
Burn, Joseph W.	2 C	do.
Cathcart, Wm....	1 C	Lvrpool.
Cavalli. B.	2 C	N Shlds.
Ford, Wm. Y. ..	1 C	Leith.
Garden, Wm. ...	1 C	London.
Hall, John	2 C	Leith.
Hamilton, J. A.	1 C	do.
Hendry, Thos. ...	1 C	Greenock
Inglis, George T.	1 C	Leith.
McKay, John ...	2 C	do.
McGregor, D. A.	1 C	London.
Mitchell, Danl. ..	2 C	do.
Morris, John......	1 C	do.
Munro, Duncan	2 C	do.
Ramsay, Peter ...	2 C	Leith.
Ross, Wm. M....	1 C	London.
Scotland, Rbt. A.	1 C	Leith.
Taylor, John ...	1 C	N Shlds.
Thomson, Robt.	1 C	Leith.
Watson, John J.	2 C	N Shlds.
Watson, John W.	1 C	Lvrpool.
Wilson, T. T. ...	2 C	N Shlds.
Wood, John......	2 C	Leith.

February 17th, 1883.

Campbel, A. ...	2 C	Glasgow.
Dees, John H. ...	2 C	W Hrtpl.
Fraser, John......	2 C	London.
Fairey, Wm.......	2 C	W Hrtpl.
Garritson, C. ...	1 C	Glasgow.
Graham, Jn. W.	2 C	do.
Grant, Wm. H.	2 C	N Shlds.
Hannah, Robt.	1 C	Glasgow.
Hedley, Wm. ...	2 C	N Shlds.
Inglis, Wm. F.	1 C	Lvrpool.
Jackson, Jno. J.	2 C	N Shlds.
Johnston, Henry	2 C	do.
Lindsay, J. F. ...	2 C	W Hrtpl.
Mace, S. F.	1 C	London.
MacLeod, J.......	1 C	Glasgow.
Mann, John J. ...	2 C	London.
Martin, James ...	1 C	do.
McGregor, John	2 C	Glasgow.
McPhedran D....	1 C	do.
Miller, Robt. ...	2 C	Glasgow.
Munro, John ...	2 C	Leith.
Piggford, Thos.	2 C	W Hrtpl.
Prodham, H. ...	2 C	do.
Richardson, G W.	2 C	N Shlds.
Robertson, J. ...	2 C	Leith.
Robinson, R. H.	1 C	W Hrtpl.
Rymer, James ..	1 C	Glasgow.
Saunders, R. T.	2 C	Lverpool.
Scudder, G. W.	2 C	do.
Sharp, T.	2 C	Glasgow.
Smith, T. Mc. A.	2 C	do.
Swan, J. N.	2 C	London.
Turnbull, C.......	2 C	N Shlds.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from January 19th to February 19th.

318 A. Schindler (communicated to H. J. Hadden). Hurricane lanterns.

320 B. Harlow. Furnaces.

358 Huston Ship Berths Co. (communicated to H. H. Lake). Sleeping berths.

364 C. G. Franklyn (communicated to S. Pitt). Moveable torpedoes.

425 G. W. Storer (communicated to J. H. Johnson). Valve gear for engines.

443 J. Donaldson. Steering apparatus.

451 W. Carter. Paddles.

470 C. J. Galloway and J. H. Beckwith. Governors.

484 E. Delpech (communicated to A. M. Clarke). Steam boilers.

500 G. S. Dodman. Raising wrecks, &c.

506 J. Frazier (communicated to E. P. Alexander).

541 S. Plimsoll. Method of coaling.

556 T. English. Variable Expansion gear.

558 C. H. Ziese. Marine boilers with undergrate blast.

562 P. Gouchot (communicated to J. H. Johnson). Water level regulators.

575 Huston Ship Berth Co. (communicated to W. R. Lake). Ships' sleeping berth.

579 J. Stewart. Paddle-wheel floats.

582 J. H. Vidal. Chain coupling.

642 D. Paddick. Furnaces and boilers.

643 J. G. Etchells. Hydraulic engines.

645 J. Robson. Motive power engines.

649 W. Rowan. Pistons.

654 T. C. Fawcett and J. C. Hargreaves. Boiler explosion prevention.

669 S. Heimann. Prevention of damage from collision.

677 A. Pinkerton. Boiler furnaces.

680 R. Matthews. Multiple cylinder compound engines.

708 G. D. Davis. Steering gear.

717 J. Bowman. Binnacle lamps.

726 F. Livet. Furnace bars, &c.

756 A. Noble. Gun carriages.

768 L. W. Broadwell. Fastening armour plates.

770 W. B. Wilson. Trawling nets.

784 W. Knowles. Governing steam engines.

785 C. Elliott (communicated to W. P. Thomson). Feed water purifyer.

816 P. B. Elwell and T. Parker. Steam engines.

819 T. F. Craven. Sleeping berths.

827 J. Whitley, Governors.

849 W. B. Tulley. "Braking" a ships' way or veering it.

854 R. M. Steele. Screw propellers.

873 A. E. Maudeslay, Holding ropes or lines of vessels.

878 D. Gilchrist and J. Barr. Ship ventilation.

879 J. Hamilton and R. McIntyre. Berths.

890 Automatic Safety Boiler, &c., Co. (communicated to H. H. Lake). Maintaining water level in boilers.

893 J. Freedy. Steam ship machinery.

912 D. Pattison. Davits, raising and lowering, &c.

MESSRS. CROSBY LOCKWOOD & CO. have in active preparation and will publish, it is hoped, in the autumn, an extensive work on British Mining by Mr. Robert Hunt, the well-known keeper of Mining Records. The book will, we are informed, comprise a thoroughly practical treatise on the metalliferous mines and minerals of the United Kingdom, dealing comprehensively with the theories of mineral deposits, the history of mines, their practical working, and the future prospects of British mining industry. The work will be fully illustrated. A most intimate connection with the mines and miners of the United Kingdom, extending over nearly forty years, and the collection and compilation of the "Mineral Statistics" for thirty-five years, must necessarily have given Mr. Hunt an insight into the theory and practice of all that relates to metalliferous mining, which few other persons can possess, and we may therefore expect that the subject will receive the most ample treatment at his hands.